Oral Health Status of Students in One Mid-Western University

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Glossary of Terms

CDC	Center for Disease Control
CI	Confidence Intervals
Cleft lip and Palate:	is a birth defect that occurs when the tissue of the lip or palate of the fetus do not fuse very early in pregnancy. It is sometimes referred to as harelip. It is an opening in the upper lip that can extend to the base of the nostril. A cleft palate is an opening in the roof of the mouth.
Dental Caries:	Aa progressive destruction of bone or tooth
Dental Plaque:	Soft thin film of food debris and dead cells forming on the teeth, which provides a medium for harmful bacterial growth. It plays a role in development of dental caries and periodontal as well as Gingivitis.
DVOI:	Dental visits due to oral health issues.
Gingivitis:	Inflammation of the outer soft tissue of the gums. Gingiva will appear red, swollen and bleed easily.
OR	Odds Ratio
Periodontitis Disease:	Bacterial infection that destroys the attachment fibers and supporting bones that hold the teeth in the mouth. If left untreated, it will lead to tooth loss.
P-value	the probability of obtaining a result equal to or "more extreme" than what was observed, when the null hypothesis is true. In frequentist inference, the p-value is widely used in statistical hypothesis testing, specifically in null hypothesis significance testing.
Salivary pH:	The pH level of a clear viscous fluid that is secreted by the salivary glands in the mouth called the Saliva. It contains water, protein, salt that moisturizes and cleans the oral cavity. The normal pH level should be between 5.6 and 7.9.
SDOH:	Self-described oral health.
SDOHCP:	Self-described oral health compared to peers.
Soft Mucosa:	Soft thin layer that lines the oral cavity & passages

Temporomandibular Joint Syndrome:	Pain and comprised movement of the jaw, joint and surrounding muscles affecting the head, jaw and face that are caused when the jaw joints and muscles controlling them don't work together correctly
Tooth Demineralization:	Tooth loss of minerals such as Calcium from the tooth matrix caused by exposure to acidic substances. It occurs during the formation of dental caries.

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Abstract

A web-based survey of the students at the university of Michigan-Flint was conducted using the Qualtrics system to evaluate oral health status. The objective of the study was to investigate the association between demographics, oral hygiene & lifestyle behavior, self-described general health and depression and oral health status with access to healthcare services and use of fluoridated water as control variables. Oral health status was defined by three dependent variables, namely, self-described oral health (SDOH), self-described oral health compared to peers (SDOHCP) and dental visits due to an oral issue (DVOI). It was hypothesized that proper oral hygiene and lifestyle behavior will be positively associated with oral health status. It was also hypothesized that depression and fair/poor self-described general health are associated with fair/poor self-described oral health status. In addition, it was hypothesized that younger age will be associated with fair/poor oral health status. 226 students responded to the survey with the majority being female (77.9%). Significant positive association between oral hygiene behavior described by daily teeth brushing and excellent/good SDOH (P=0.03, OR=6.05, 95% CI 4.51-8.13) and better/same SDOHCP (P=0.05, OR=4.87, 95% CI 3.76-6.30), while significant positive association between frequency of teeth brushing was found with excellent/good SDOH (P=0.04, OR=2.12, 95% CI 1.03-4.37). Self-described general health status was found to have strong positive association with both excellent/good SDOH (P=0.01, OR=5.32, 95% CI 2.24-12.63) and better/same SDOHCP (P=.01, OR=3.11, 95% CI 1.33-7.27). Access to health care services described by frequency of dental visits and frequency of hygienist visits were found to have strong positive association with excellent/good SDOH (P=.01, OR=2.74, 95% CI 1.30-5.76) and (P=.01, OR=2.86, 95% CI 1.35-6.06), respectively and DVOI (P=0.01, OR=9.55, 95% CI 3.3-27.66) and (P=0.01, OR=13.45, 95% CI 4.03-44.83), respectively. Use of fluoridated water was found to have significant positive association with excellent/good SDOH (P=0.04, OR=2.12, 95% CI 1.01-4.45). These findings support the first hypothesis in this work that a positive association exist. No association was found between depression as an independent variable and any of the oral health status indicators such as SDOH, SDOHCP and DVOI, where P>0.05 and 95% CI of OR crossed 1. This finding refutes the second hypothesis in this work, which states that a positive association exists. In addition, no association was found between younger age and SDOH, SDOHCP and DVOI, where P>0.05 and 95% CI of OR crossed 1. This result also refutes the third hypothesis in this work. Lifestyle behavior described by oral health issues interfering with work, life and school was found to have significant negative association with SDOH (P=0.01, OR=0.26, 95% CI 0.10-0.65) and significant positive association with DVOI (P=0.01, OR=4.74, 95% CI 1.86-12.09), which was an unexpected result but was rationalized as an outlier since students responded to this question without relating it to their own SDOH and DVOI. A binary regression model was developed for each of the three oral health status indicators to try to predict future outcomes. The accuracy of the regression models for both SDOH and DVOI was very good, while the accuracy of the model for SDOHCP was found to be inadequate.

Chapter I- Introduction

Oral health is an essential and integral part of overall health throughout human life. The mouth is the mirror that reflects human's health and well-being. Studies have shown evidence of linkage between bacterial mouth infections such as dental caries, gum disease and increased risk of heart disease, premature delivery of pregnant women and complicated control of blood sugar for diabetics (Snyder & Haveman, 2013; De Oliveira, Watt & Hamer 2010). Poor oral health has negative consequences on individuals' behaviors, which may affect an individual's performance at school, home and work as well as the individual's concentration and self-esteem. Individuals cannot enjoy their food and are shy to laugh and are unable to socialize. Sometimes they feel neglected and inferior to other healthy people (Holt & Barzel, 2013). Oral health problems are usually the first signs of other bodily health issues such as infectious diseases, immune disorders, nutritional deficiencies, stroke, lung disease and cancer (Department of Health and Human Services, 2000).

Ten percent of adults aged 18 years or older suffered tooth loss due to dental caries or periodontal disease in the United States. In addition, 22% of adults 18 years or older suffered facial pain due to oral issues. One out of six experienced toothaches, one out of twelve suffered oral sores and one out of fourteen has jaw pains. These oral diseases and oral aches have a great effect on human performance as well as individuals' quality of life (Department of Health and Human Services, 2000). Despite the huge progress in the reduction of dental caries in the United States, disparities still exist among certain ethnic and poor populations, where 84.7% of adults 18 years of age or older have dental caries. Adults' that are non-Hispanic, black or Mexican Americans have higher proportion of untreated dental caries (Department of Health and Human Services, 2000) due to oral health disparities that are among disadvantaged ethnic minorities.

These minorities experience a higher level of disease and lower level of access to care and resources.

For an important topic, such as this, governmental agencies have concentrated on collecting data to understand and improve oral health issues, help address causes of such issues and measure improvements (Snyder, 2013; DHHS, 2000). However, target populations in such studies were either school children, working adults or senior citizens. The literature dealing with the issue of oral health status of college students in the United States is very sparse (Dogan & Goekalp, 2014). Oral health among college students is very important to research as many younger college students live away from home for the first time with minimal parental guidance.

The studies on college students (Anonymous, 2010; Luebke & Driskell, 2010) dealt with oral hygiene behavior such as tooth brushing and flossing, consumption of sugary foods and the frequency of dental visits per year; these studies did not assess students' oral health status such as presence of pain or caries. Multiple published studies dealt with the same oral hygiene behavior such as tooth brushing and flossing, consumptions of sugary foods and the frequency of dental visits per year at different universities throughout the world (Åstrøm & Masalu, 2001; Peltzer & Pengpid, 2014; Al-Zarea, 2013; Al-Ansari, Honkala & Honkala, 2003; Rimondini, Zolfanelli, Bernardi & Bez, 2001; Bou, Miquel, & Poisson, 2006).

In addition to the limited research on the oral health status of college students, there is limited research on how various factors such as depressive symptoms may affect college students' oral health. Depressive symptoms among adults have been shown to affect use of oral health services in general (Bernson, Elfstrom & Hakeberg, 2013).

Symptoms of depression include difficulty of concentration and remembering details as well as difficulty in making decisions. It also includes symptoms such as fatigue, decreased

energy, feelings of guilt, worthlessness, insomnia or excessive sleeping, irritability, restlessness, loss of interest in activities or hobbies, overeating or appetite loss, persistent aches, cramps or digestive problems and thoughts of suicide (Park, Ko, Shin, Ha, Kim & Kim, 2014).

Depression has been shown to influence poor health outcomes in general as well as oral health behavior such as oral hygiene and accessing oral health services (Park, 2014). For example, psychological distress is a risk factor for poor oral health (Park, 2014), where it was shown that people with depressive symptoms had a lower tooth brushing frequency as well as a lower frequency of dental visits than those without depressive symptoms. A depressed person lacks concentration, which may lead to missing on dental appointments, while feeling sad will demotivate a person from utilizing oral health services as well as performing proper oral hygiene behavior and be compliant with recommended dental practices. In addition, depression affects salivary glands by decreasing the salivary flow, which promotes the growth of carious legions. Depressed patients tend to increase their sugary food and carbohydrates intake, which encourages the growth of cariogenic bacteria that increases the risk of dental caries and poor oral health (Park, 2014).

The association between dental fear, anxiety, general clinical anxiety and depression among finish university students was studied (Halonen, Salo, Hakko & Räsänen, 2014). It was found out in this study that higher dental anxiety was associated with higher levels of clinical anxiety and depression among females, while in males, dental anxiety was only associated with clinical anxiety. For the factors of dental anxiety, only anticipatory dental anxiety was related with clinical anxiety or depression in males. In females, anticipatory and treatment dental anxiety were associated with depression.

In a study conducted by Okoro et al. (Okoro, Strine, Eke, Dhingra & Balluz, 2012), the authors studied the association between depression and tooth loss as well as the use of oral health services. They found out that adults with current depression, lifetime diagnosed depression and lifetime diagnosed anxiety were significantly more likely to have had at least one tooth removed than those without each of these disorders. The Authors concluded that the use of oral health services and tooth loss was positively associated with depression and anxiety.

Multiple studies dealt with accessibility of dental care in the United States, where millions of Americans lack access to basic oral care. This has largely affected oral health disparities among underserved individuals and groups in the United States (DHHS, 2000). Inequities that exist in systemic health and healthcare are also existent in oral health care. The disadvantaged populations that have low income and little education as well as racial and ethnic minorities have experienced higher level of disease and lower levels of healthcare than the general population (DHHS, 2000). Therefore, in this study, the accessibility to oral health care will be utilized as a control variable.

Previous studies dealt with access to fluoridated water supply in the United States (DHHS, 2000; CDC 1999). This preventive measure had a great effect on the promotion of oral health status and on the reduction of dental caries among American communities who have access to fluoridated water. Therefore, access to fluoridated water supply will be utilized as a control variable as well.

The purpose of this study is to investigate the demographics as well as oral hygiene and lifestyle behaviors of college students at a Midwestern University. The study will also investigate perceived general health and mental health determinants that affect self-described oral health status among college students. The study will investigate the association between self-described

oral health status and positive oral hygiene behaviors (brushing and flossing), negative lifestyle behaviors (smoking and sugary food/drink consumption), self-described general health and depression among college students attending the University of Michigan-Flint. The investigator targeted university students in this study because at this stage in their life, they live away from their home for the first time. They become more responsible to make their own life style and behavioral choices, that might affect their health and quality of life.

In the next section, gaps in the oral health research related to college students are presented in greater detail as well as presenting a conceptual framework that guided the development of the current study.

Chapter II- Literature Review

This study will focus on understanding the demographic, oral health behavioral, lifestyle behavior, self-described general health and mental health determinants that affect reported oral health status among college students attending one mid-western university, specifically the University of Michigan-Flint. University students are in a dynamic transition period of growth and development that bridges the adolescent stage to adulthood. At this stage, many of these students live away from home for the first time in their life and they are faced with the responsibility for their own personal health lifestyle and behavior. During this period, they become more autonomous and their oral hygiene & lifestyle behaviors and depression levels may affect their self-reported oral health status and their health status in general. This also means that they develop lifestyle habits that could affect their health and quality of life for the rest of their lives (Snyder, 2013; DHHS, 2000).

In this review, the financial burden of oral health as well as its accessibility will be discussed. A conceptual framework that helps provide an overview of the various factors affecting oral health is presented as well. The review will then focus on published studies about the influences of demographics, oral hygiene behavior, lifestyle behavior and depression on oral health. Studies related to oral health among college students will also be presented to identify gaps in the research.

Oral Health Financial Burden & Accessibility

In this sub-section, the financial burden of oral health is presented due to its impact on the United States. In 2010, an estimated $108 billion was spent on dental services in the United States (CDC, 2011). In addition, there were indirect costs to oral diseases and their treatment in

the form of lost days and years of productive work (CDC, 2006; National Children's Oral Health Foundation NCOHF, 2015).

Due to the overall high costs of care and the geographic inaccessibility of providers, one third of Americans lack access to preventive and dental primary care (Garcia, 2010; Tetrick, 2011). This issue is exasperated when dealing with college students as many of them rely on limited university insurance until recently where the Patient Protection and Affordable Care Act (PPACA) became law in 2014 allowing students to be covered under their parent's health plan until the age of 26 or have access to affordable (<$100/month) health insurance coverage (U.S. Department of Health & Human Services, 2015).

In a report published by Delta Dental in 2010, the data from 2009 show that for every person without medical insurance, there are approximately 2.8 people without dental insurance and despite the fact the almost 85% of the total US population have medical coverage, only 57% of them have dental coverage. Among those without dental benefits, "lack of insurance" was the most commonly cited reason (44%) for not visiting the dentist. Individuals living with an income below 200% of poverty level were more than twice as likely to report delaying dentist visits because of cost (Delta Dental, 2010).

In summary, oral health issues have a huge financial and social impact on personal, community and national wellbeing and quality of life.

Fluoridated water and oral health

Accessibility to fluoridated water has proven to be the safest and most effective public health intervention to improve oral health status and quality of life. Since 1930, several dental scientists could document that people receiving proper amounts of fluoridated water have less tooth decay than those who did not (CDC, 1999). In 2012, about 74.6% of the United States

population had access to fluoridated water through the public water system use (DHHS, 2015). This intervention was cost-effective since for each dollar invested there was a $38 savings of dental cost. Healthy People initiatives was to increase the proportion of people who have access to community fluoridated water by 79.6% by 2020 (DHHS, 2015).

People in the United States take 75% of their fluoride from water and processed beverages. Most Americans receive their water from the public system where 11% buy their water from private investors and 15% in rural areas use their own wells (CDC, 2010). It is very important to identify the source of water supply for each student to be able to improve his or her oral health.

In summary, water fluoridation is an intervention method to combat dental caries that is cost-effective and can reach millions of people and decrease the burdens of oral health diseases.

Conceptual Model: Factors Affecting Oral Health

In this section, a conceptual model that demonstrates the various factors influencing oral health will be discussed. The parts of the conceptual model the current research investigates will also be specified.

To improve oral health status among college students, one must understand the factors that influence oral health. As suggested in previous studies (Fisher-Owens, Gansky, Platt, Weintraub, Soobader, Bramlett & Newacheck, 2007) and due to the increasing interest in a more comprehensive approach, a four-level social-ecological model has been implemented. The model considered the complex interplay between individual, relationship, community, and societal factors. It allowed researchers to understand the range of factors that put people at risk to improve their oral health status. The overlapping rings in the model shown in Figure 1 illustrates how factors at one level influence factors at another level.

The framework proposed by Fisher-Owens (Fisher-Owens, 2007) classified determinants of oral health status into 5 broad domains and is shown in Figure 1: genetics and biology, social environment, physical environment, health-influencing behaviors, and medical care. Drawing on these theories, key concepts in the development of a theory for oral health include multiple levels; interactions across levels, time, and space; equilibria and feedback loops; and the concept of vulnerability and resilience.

In this model adopted for this study, the core is the oral health status of a college student, which includes the diet, the host's general and oral health and the bacteria or microflora affecting oral health. The second level is the college student level influences that include factors such as depression, access to dental care services (dental insurance), self-perceived general health status, oral hygiene behavior, physical and demographic characteristics and lifestyle behavior.

The third level is the family-level influences, where socioeconomic status, social support, physical safety, culture, family function and health practices of the family plays a role in a college student's oral health status.

The fourth level is the community influence, which includes factors such as social interaction, dental and health system characteristics, physical safety and environment, social capital and culture that the student lives in. Depression also fits in this level as many of these community-level influences might exasperate depressive symptoms among students.

In our study, not all factors included in this model are used due to time constraints and resource limitations. Influences such as oral hygiene behavior at the individual student level as well as dental visits, access to dental care and access to fluoridated water at the community level were studied. Lifestyle behaviors such as smoking and sugary foods/drinks intake at the individual level was also included. As well as self- perceived general health at the individual

level was included. Of importance to the study was the factor of student depression and its effects on oral health.

In the next sections, prior research on demographics, lifestyle, and depression on oral health in the general population is discussed.

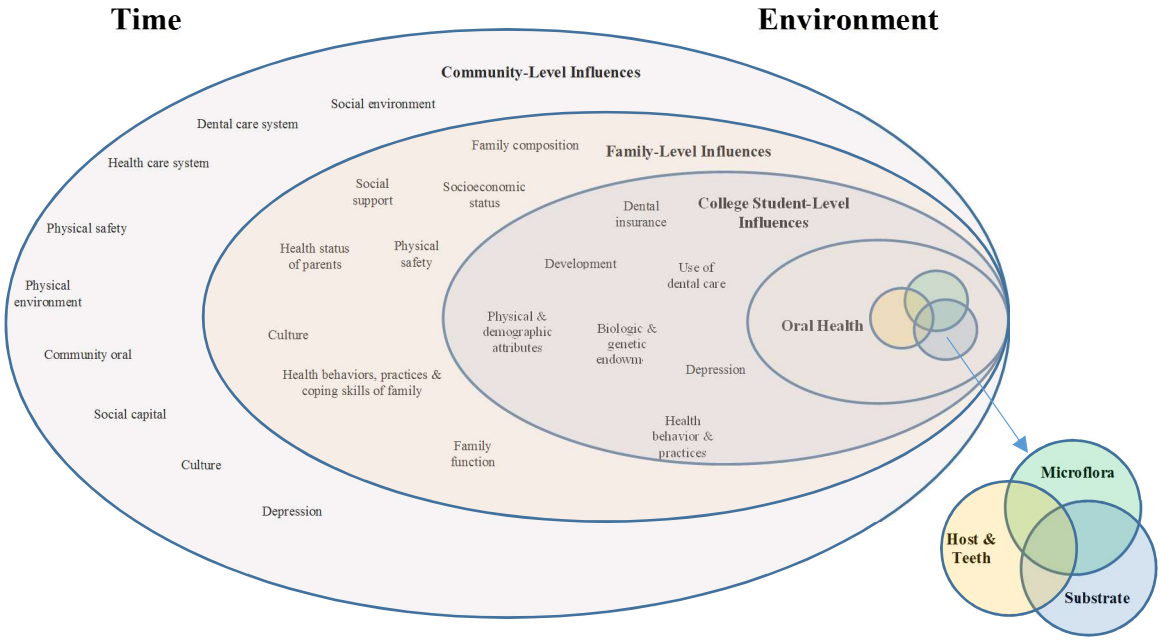

Figure 1. *Oral health conceptual model proposed by Fisher-Owens*

Demographics & Oral Health Status

Oral health status varies based on demographic factors such as age, gender, race and socio-economic status such as family income, educational level and occupation status (Snyder, 2013; DHHS, 2000). Groups that are at high risk of poor oral health are minorities such as African Americans, Hispanics and Native Americans and immigrants (Delta Dental, 2010; DHHS, 2000).

Age

Dental caries is the most chronic childhood disease. 50% of 5 to 9 years old children have one or more cavities while the proportion increases to 78% among adolescents who are 17 years old (NIDCR, 2014). 14% of adults aged 45 to 54 years old suffer from severe periodontal disease while 23% of 65 to 74 years old have severe periodontal disease. 30% of adults who are 65 or older suffer from tooth loss compared to 46% twenty years ago. It was also published in a study that good oral hygiene practices were strongly associated with older age among college students (Biradar, Hiremath, Puranik, 2013).

Gender

In general, males tend to have higher levels of periodontal diseases, either due to more tobacco use or differences in personal care and frequency of dental visits (DHHS, 2000). Studies have reported that oral health knowledge was statistically significantly higher among college female than among male students (Biradar, Hiremath, Puranik, 2013). Females had more positive dental health attitudes and behaviors such as making regular visits to the dentist and being more educated about professional tooth brushing (Biradar, Hiremath, Puranik, 2013).

Culture, Race & Ethnicity

The factors affecting cultural, racial and ethnic disparities in health include differing health behaviours, medical decision-making, quality and access to care, and cumulative effects of discrimination (Nicklett, 2011). One of the studies has reported that Hispanic children have the poorest dental health and lowest preventive dental care utilization, followed by African-American then White children. The authors of the study reported that their model accounted for

58% to 77% of the disparities in dental health and 89% to 100% of the disparities in preventive dental care (Hilton, Stephen, Barker & Weintraub, 2007).

Culture plays an important role in human societies, where every culture has its own customs that might have significant influence on health in general and oral health. It is now fairly accepted that cultural factors are deeply embedded in the whole way of life such as in matters of nutrition, immunization, personal hygiene, family planning, child raising and seeking early medical care. Dental fear, whether derived from prevailing community beliefs or personal negative dental experiences, greatly influences attitudes regarding accessing preventive care (Biradar, 2013).

Socioeconomic Status

Socioeconomic status is strongly associated with health status in general and oral health. Reports have shown that poor children suffer twice as much dental caries as their affluent peers and their dental disease is more likely to be untreated (NIDCR, 2014). These poor and non-poor differences continue into adolescence, where one out of four children in the United States is born into poverty. Children living at or below the poverty line have more severe and untreated tooth decay. This is due to many factors such as insurance availability, inability to perform certain oral hygiene practices and the inability to visit a dentist (Snyder, 2013; DHHS, 2000).

Socioeconomic status accounted for 71% of the gap in preventive dental care between African American children and White children and 55% of that between Hispanic children and White children (Hilton, 2007). Adults who are aged 35 to 44 years old with less than high school education experience untreated tooth decay and destructive periodontal disease nearly three times that of adults with some type of college education (CDC, 2006).

In summary, demographics such as age, gender, culture, race, ethnicity and socioeconomic status play a role in a college student's self-described oral health status. A major influence is the age category, where age plays an important role in the oral hygiene behaviour of college students especially when they enter the university and are in a transitional state between home and school.

Oral Hygiene Behavior & Oral Health Status

Positive Oral Hygiene Behavior

The World Health Organization (WHO) and the International Federation of Dentists promote good oral hygiene at the population level (Olusile, Adeniyi, & Orebanjo, 2014). A preventive strategy such as tooth brushing and flossing at the individual level helps reduce the negative impact of oral diseases and improves the quality of life. Research indicates that the removal of plaque by brushing and flossing is essential for the prevention of the two most prevalent dental conditions: dental caries and periodontal disease (Ainamo & Parviainen, 1979). The frequency of brushing is recommended by the ADA to be at least twice daily (after wakeup and before sleep) as well as brushing and flossing after each meal (ADA, 2013).

Negative Lifestyle Behavior

Negative lifestyle behaviors such as tobacco use and poor dietary choices are examples of social factors that can contribute to differences in oral health status (Snyder, 2013; DHHS, 2000). The theory of behavioural studies suggests that people from low socioeconomic backgrounds are more likely to engage in behaviours that are damaging to their health and thus have higher levels of disease (Biradar, 2013). Healthy lifestyles influenced the oral health status of those living in deprived and middle circumstances but not on the privileged (Biradar, 2013).

One negative behavior that affects oral health status is smoking. Clinical studies showed that current or former smokers manifested a higher prevalence of oral health problems than those who have never smoked (Millar & Locker, 2007; ADA, 2013). These findings suggest that smoking is associated with both the prevalence and severity of periodontal disease. In an analysis of the effects of smoking on overall periodontal disease rates in the United States, it was estimated that 41.9% of periodontitis cases were attributable to current smoking and 10.9% were attributable to former smoking (Millar, 2007). A longitudinal study of smoking and oral pain stated that smokers have higher risk of having oral pain than no-smokers, but when they stop smoking, the risk of pain decreases significantly (Riley, Tomar & Gilbert, 2004).

Another negative lifestyle behavior is the poor dietary choices such as sugary food and drink consumption. The relationship between sugary foods and drinks and oral health has been studied in the literature (Touger-Decker & van Loveren, 2003). Sugars after being exposed to saliva provide a fertile ground for oral bacteria that produces acid and increases salivary acidity. Tooth demineralization will occur which in turns lead to caries and dental decay (Touger-Decker, 2003). Factors besides sugars that affect the caries process include type of food or fluid, duration of exposure, nutrient composition, sequence of eating, salivary flow, presence of buffers, and oral hygiene (Moynihan & Petersen, 2004). Studies have confirmed the direct relation between intake of dietary sugars and dental caries across the life span.

Depression and Oral Health

The association between oral health status and depression has been studied in the past. Researchers found that levels of depression were significantly higher among irregular attendees of dental clinics compared with regular attendees (Bernson, 2013). They showed that gender,

dental anxiety, general anxiety, and the lack of the coping strategy were predictors of irregular dental care.

Researchers in Korea examined the association of depression with oral health behaviors and oral health status using a large nationwide sample of Korean adults. The researchers used a sample size of 6,139 participants aged 19 years or older (Park, 2014). Results showed that Participants with lifetime self-reported depression (past or present) brushed their teeth less frequently and were more likely not to receive treatment when experiencing dental problems than those without depression after the researchers adjusted for sociodemographic factors, gender, and age. After adjusting for significant oral health behaviors, current smoking status, and sociodemographic factors, participants with depression had poorer oral health status than those without this disorder. The researchers concluded that depression was significantly associated with oral health status, even after adjusting for the impact of oral health behaviors in Korean adults.

The association between depression and oral health status could be explained by both biological and behavioral mechanisms (Park, 2014). First, the association between the growth of oral bacteria and antidepressants was well documented in the literature. In addition, many studies found that depression is a risk factor for the inhibition of immune functions (Park, 2014). Second, the person suffering from depression symptoms is more likely to have adverse oral lifestyle behavior such as sugary foods and drinks consumption and to some extent smoking, which are behaviors that are usually associated with depression and can subsequently lead to poor oral health outcomes.

Studies on Oral Health Status among College Students

Oral health status among college students is a very important topic to research as many younger college students live away from home for the first time with minimal parental guidance (Kojima, Ekuni, Mizutani, Furuta, Irie, Azuma, . . . Morita, 2013). They must cope with this transition as well as dealing with all the challenges that college life presents. Their oral health status could have adverse effects on their lives and their academic careers.

To look for credible publications, the investigator of this study researched several databases such as CINAHL Complete and PubMed through the Thompson library at the University of Michigan-Flint. The investigator also looked for relevant literature from the National Health Interview Survey (NHIS), National Institute of Health (NIH), the Center for Disease Control (CDC), U.S. Department of Health & Human Services (HHS), Biomedcentral.com, healthypeople.gov, National Children's Oral Health Foundation, National Institute of Dental and Craniofacial Research (NIDCR) and State of Michigan website. The relevant literature to the study topic at hand is summarized in Table 1 below.

Most published research in the US examined oral diseases that affect adults in general ages 35 years and older or children attending school and rarely focused on college students (CDC, 2011; CDC 2014; Delta Dental, 2010; Snyder, 2013; Tetrick, 2011). Some published studies have researched the issue of oral hygiene among college students, to examine different life style trends such as sugar and pop consumption habits (Luebke, 2009; Åstrøm, 2001; Peltzer, 2014; Al-Zarea, 2013) (Table 1). Few studies published in the US have focused on oral hygiene behaviors, poor oral hygiene and demographics among college students. The researchers hypothesized that college female students have better oral hygiene habits and consumed less sugar than male students (Luebke, 2009; Peltzer, 2014). The researchers reported females

brushed their teeth more often than males and only one third of the participants flossed the recommended once daily (Luebke, 2009; Peltzer, 2014).

Peltzer and Pengpid investigated the oral health behavior such as brushing and going to the dentist and other factors in low, middle and high income countries (Peltzer& Pengpid, 20014). They conducted a survey among more than 19000 university students attending 27 universities in 26 different countries. After applying multivariate logistic regression analysis, they found that inadequate tooth brushing and rare visits to the dentists among males is associated with weak beliefs in the importance of tooth brushing, depression and PTSD symptoms, tobacco and use of frequent gambling, low physical activity and low daily meal and snacks frequency. The oral health behavior among students was found to be low.

Since college students represent a diverse community with different socio-economic backgrounds, cultures and ethnicities, the proposed research will give insight into the determinants leading to oral health issues among this group which have not been targeted for research previously. This data that will be gathered to help universities and health officials to understand patterns of health behaviors among students to create intervention programs targeting this group to enhance their oral health status as a way of enhancing their quality of life and thus positively affecting their college experience and achievements. A web search was conducted by the investigator of this study, which revealed that only universities in the US that offer dental programs usually have clinics that offer services to students at a reduced cost.

In summary, very few studies have dealt with the issue of oral health status among college students in general and its association with depression, self-perceived general health, oral hygiene and lifestyle behavior.

Table 1. *A summary of published literature on oral health among university students*

Study Title	Authors	Goal of study	Geographic Region	Number of Participants	Results of Study
Oral health knowledge and behavior among male health sciences college students in Kuwait	Al-Ansari, Honkala, & Honkala	This study aims to find out oral health knowledge and oral health behavior of male Health Sciences College students.	Kuwait, Middle East	153	Male Health Sciences College students seemed to have appropriate knowledge on some oral health topics, but limited knowledge on others. Their tooth brushing practices are still far behind the international recommendation (twice a day) and the knowledge, why it should be done so frequently is very limited.
Oral health knowledge of periodontal disease among university students	Bader K. Al-Zarea	The aim of this study was to evaluate levels of oral health knowledge of periodontal disease among non-dental university students	Saudi Arabia, Middle East	250	There were significant differences in oral health knowledge regarding periodontal disease between students from different levels of studies and different disciplines.
Oral health behavior patterns among Tanzanian university students: a repeat cross-sectional survey	Anne Åstrøm and Joyce Masalu	The study examines oral health behavioral trends and the development of socio - demographic differences in oral health behaviors among Tanzanian students between 1999 and 2000.	Tanzania, Africa	635 students	Cross-tabulation analyses revealed that in 1999, the rates of abstinence from tobacco use, and of soft drink consumption, regular dental checkups, and intake of chocolate/candy were 84%, 51%, 48%, and 12%, respectively, among students of urban origin and 83%, 29%, 37%, and 5% among their rural counterparts. The corresponding rates in 2001 were 87%, 56%, 50%, and 9% among urban students and 84%, 44%, 38%, and 4% among rural ones. Multiple logistic regression analyses controlling for sex, age, place of origin, educational level, year of survey, and their interaction terms revealed a significant increase in the rate of soft drink consumption, implementation of oral hygiene measures, and abstinence from tobacco use between 1999 and 2001. Social inequalities observed in 1999, with urban students being more likely than their rural counterparts to take soft drinks and go for regular dental checkups, had leveled off by 2001
Oral health status of 1500 university students in Toulouse France	Bou, Miquel, & Poisson	The purpose of this study was to assess the oral health status among a population of students enrolled in the first year at the Paul Sabatier University in Toulouse (France), and to compare the results with those of similar investigations.	France, Europe	1500 students	The Decayed, Missing and Filled Teeth (DMFT) index of these students was 4.4 (Standard Deviation = 3.72) (D = 1, M = 0.042 F = 3,454). Of the 1500 subjects, 27.6% smoke, while 43% eat sweets on a regular basis. The female students are more careful with their dental health (tooth-brushing frequency and mouthwash use are statistically significant ($p < 0.001$).
Self-assessed dental status of the first-year students of health-related faculties of a university in Turkey	Bahar Güçiz Doğan1 and Saadet Gökalp2	To determine the self-assessed oral health status and behavior of entrants educating in health-related faculties of a university, Ankara, Turkey	Turkey, Europe/Asia	853 students	The oral health practices of the entrant students were lower than expected. Although more than four-fifth of students thought that the status of their teeth and gums were good or moderate and more than half of them thought that they did not need dental treatment, almost all of them thought that if they have visited a dentist he/she will suggest some treatments or more proper tooth-brushing
A group of Midwestern university students needs to improve their oral hygiene and sugar/pop consumption habits.	Luebke TE, Driskell JA.	College women were hypothesized to have better oral hygiene habits and to consume less sugar/pop than men and that the students' habits would be different from those the students had before college	Midwest, USA	105 men and 91 women.	Three quarters of the students reported brushing their teeth at least the recommended twice daily, with women brushing their teeth more often. About a third of the students flossed at least the recommended once daily. Not quite a third of the students reported brushing and flossing their teeth more often than they did before college. More than a third reported using mouth rinses 4 or more times weekly, with 13% reporting using a fluoride-containing mouth rinse. More than 60% reported using fluoride-containing toothpaste. Slightly more than a third reported drinking fluoridated water in their younger years. A larger percentage of women than men reported that diet pop was their pop of choice. More than two thirds of the students that drank pop indicated that regular pop was their favorite. Most of the students reported consuming sugary foods more than once daily, but they indicated that most of these sugars were not sticky. Few differences were observed in oral hygiene and sugar/pop consumption habits of these college students by sex.
Oral health behavior and social and health factors in university students from 26 low, middle and high income countries.	Peltzer & Pengpid	investigate oral health behavior (tooth brushing and dental attendance) and associated factors in low, middle and high income countries	26 countries across Asia, Africa and the Americas	19,560 students	Results indicate that 67.2% of students reported to brush their teeth twice or more times a day, 28.8% about once a day and 4.0% never. Regarding dental check-up visit, 16.3% reported twice a year, 25.6% once a year, 33.9% rarely and 24.3% never. In a multivariate logistic regression analysis, being a male, coming from a wealthy or quite well off family background, living in low income or lower middle income, weak beliefs in the importance of regular tooth brushing, depression and PTSD symptoms, tobacco use and frequent gambling, low physical activity, and low daily meal and snacks frequency were associated with inadequate tooth brushing (<twice daily). Further, being a male, older age, coming from a not well off or poor family background, living in low income or lower middle income, weak beliefs in the importance of regular tooth brushing, PTSD symptoms, illicit drug use, low physical activity, and low daily snacks frequency, skipping breakfast and inadequate fruit and vegetables consumption were associated with less than one annual dental care visit. Oral health behavior among the students was found to be low
Among the Uninsured: 1.7 Million College Students	Elizabeth Redden	Insurance coverage status of college students	USA	340 randomly selected colleges	About 1.7 million traditional-aged college students, or 20 percent, are uninsured in the United States. And student health plans – offered by 57 percent of all colleges – vary dramatically in terms of services covered
Self-preventive oral behavior in an Italian university student population	Rimondini, Zolfanelli, Bernardi & Bez	Assess the oral hygiene attitude and the professional preventive examination compliance in Italian university students	Italy, Europe	202 students	4 groups were identified with homogeneous oral hygiene behavior and compliance toward professional preventive examination. Only one cluster, representing 33.6% of the sample, showed consistent frequency and modalities of oral hygiene habits. The other clusters seemed to be defective with interproximal cleaning procedures and compliance toward professional preventive care. Since the sample was characterized by a young, urbanized, homogeneous group with a high educational level and frequently from an upper middle class social status, the analysis probably gives a supra-estimation of the positive behavior.
The association between dental anxiety, general clinical anxiety and depression among Finnish university students.	Halonen, Salo, Hakko & Räsänen	to evaluate the association between dental anxiety, general clinical anxiety and depression among Finnish university students	Finland, Europe	1551 students	The mean age of the respondents was 25 years. Of the respondents, 99 (11.3%) were classified as dentally anxious patients. Among females, the higher dental anxiety was statistically significantly associated with higher levels of clinical anxiety ($p<0.000$) and depression ($p<0.000$), while in males, dental anxiety was only associated with clinical anxiety ($p=0.016$). For the factors of dental anxiety, only anticipatory dental anxiety was related with clinical anxiety ($p=0.004$) or depression ($p=0.034$) in males. In females, anticipatory and treatment dental anxiety were associated with clinical anxiety and depression (all with $p<0.001$).

Hypotheses

Given the gaps in the literature and for this study, the following hypotheses will be assessed:

I. It is hypothesized that proper oral hygiene & lifestyle behaviors will be positively associated with excellent/good self-described oral health. University of Michigan-Flint students who brush, floss, do not smoke and do not consume sugary foods/drinks frequently will have a better/same self-described oral health status than those students who do not brush/floss, smoke frequently or consume sugary foods/drinks regularly.

II. It is hypothesized that depression and poor self-described general health are negatively associated with excellent/good self-described oral health status. University of Michigan-Flint students who had or still have self-described depressive symptoms are predicted to have poorer oral health status than other students who did not report any depression history.

III. It is also hypothesized that when controlling for other variables, younger age will be associated with Fie/poor self-described oral health status since college students at the University of Michigan-Flint are away from their parents and homes for the first time.

The findings of this study will help health researchers at the University of Michigan-Flint as well as in Genesee County to understand the multifaceted and interactive effects of personal and environmental factors that determine oral hygiene and lifestyle behaviors. This in turn will help those researchers to develop comprehensive behavioral and social intervention strategies to improve oral health status among college students. For example, identification of the factors that

affect students' depression and manage these factors that can affect oral health through counseling, meditation, and medication. To help improve oral health behaviors, intervention strategies can be developed such as informational support to increase students' knowledge, problem solving skills and self-efficacy to promote attitude and behavioral changes. At the family level, friends and family could be educated to help shift social norms and support student's positive oral behavioral changes. At the community level, social media and advertisement can create pressure on policy makers to improve policies that minimize barriers to oral healthcare services.

Chapter III- Methodology

Study Design

A cross-sectional descriptive design was utilized in this study. The design helped to understand the depression, oral hygiene & lifestyle behaviors, self-described general health status and their association with oral health status as self-described by the students attending the University of Michigan-Flint themselves without manipulation of their environment (O'Sullivan, Rassel & Brenner, 2008). Quantitative data was collected directly through a web-based survey using the Qualtrics system, where a close-ended questionnaire was used. The questions were written in simple English language to make it easier for participants to understand. A cross-sectional study design was carried out to collect and compare data from the population at a single point in time. Information on students' demographic characteristics was collected such as age, sex, language, income, ethnicity and education. Depressive symptoms, self-perceived general health status, oral hygiene and lifestyle behaviors such as brushing, flossing, smoking, sugary food and drinks consumption were also collected. In addition, information about the students reported oral health status were collected. The number of students who participated in this study was 226.

The campus of the University of Michigan-Flint is in Genesee County in the city of Flint, Michigan and is attended by 8600 students. Most of the students come from the surrounding areas and in recent years has accommodated a growing number of international students from over 40 countries. The University founded in 1956 as the Flint Community Junior College as a public institution and in the spring of 1970, the North Central Association of Colleges granted accreditation to the college as part of the University of Michigan system. In 1971, the name was

changed to the University of Michigan- Flint. The campus offers more than 100 undergraduate majors and over 40 graduate degrees.

Students attending the University of Michigan-Flint are comprised of 40% males and 60% females coming mainly from within the State of Michigan. Genesee County, where the University of Michigan-Flint is located, includes the city of Flint as its major urban core. The County is considered as a "community in recovery" due to the deindustrialization that happened in the 1980s and thereafter mainly from the divestment of companies such as General Motors (originated in Flint in 1908) and the depopulation as well as urban decay. The Flint area is one of the nation's leading crime areas with very high poverty levels. Due to the history, this study is of importance to address the oral health issues facing the University of Michigan-Flint students.

Sampling Method

The study took place at the University of Michigan-Flint and included all students in the university mailing list after getting IRB permission to use that list from the University. A web-based survey through Qualtrics was used to collect data from students, where a convenient sample of volunteer students who choose to participate were utilized. Every student in the mailing list received an email to clarify the purpose of the study and its importance. Students 18 years of age or more and those who could understand and communicate in English were included in the study. Those students who were younger than 18 years of age and those who refused to participate were excluded. Students who volunteered to participate had to accept the invitation as a consent acknowledgment before answering the survey, this was clearly stated in the first question of the survey. They received a link to a web-based survey with information on how to answer these questions. The investigator's contact information was included in the email in case the participants had any concerns or questions. To insure student's privacy, no questions about

their names, addresses or contact numbers were asked (Chiavo, 2007). The survey was anonymous where no names were solicited and the web link was provided for the students to access the survey and insure their privacy. A copy of the sent email is included in Appendix B. The students received this email only once to conduct the survey and a reminder email went out after 2 weeks to complete the survey. All study participants were informed that participation in the study was voluntary in the email. Professors did not recruit students and the recruitment only occurred through email. Students didn't receive incentives for their participation.

Data collection & Measures

The questions used in this survey were extracted from a questionnaire designed by the National Health interview survey (NHIS, 2009). These questions were used to collect data from the participants using a web-based Qualtrics survey system. The questions regarding depression were taken from a published study by Whooley (Whooley, Avins, Miranda & Browner, 1997).

The questions targeted six categories, namely, Demographics, access to oral health services, oral hygiene & lifestyle behavior, oral & general health status, access to fluoridated water and depression.

Outcome (Dependent), Independent & Control Variables

Oral Health Status

Oral health status self-described and reported by the students was the outcome of this study. Information about the students' oral health status was collected using questions 21 through 23. Oral health status means the way the students reported and described their own oral health status, the way the students reported and compared their oral health status to their peers as well as the absence of impairment or symptoms due to oral diseases such as discomfort and pain,

ability to chew and swallow. The questions used were designed to measure this concept (NIH, 2014) such as signs of gum bleeding, broken or loss of teeth, presence of dental caries and fillings, difficulty in chewing and eating, bad breath, toothache and facial pain. In addition, a question about self-described oral health status and how students compare their oral health status with peers was solicited.

Demographics

Demographics such as age, sex, race, ethnicity, culture, education and socio-economic status are independent variables in this study. The survey questions collected information about the participant's demographic characteristics using questions 1 through 7.

Oral Hygiene & Lifestyle Behavior

Oral hygiene behavior as an independent variable was measured through indicators such as brushing (question 12), flossing (question 13), frequency of brushing and flossing (question 14), duration of brushing time (questions 15), flossing and use of fluoridated tooth paste and interdental brushes (question 13). These positive oral hygiene behaviors help prevent oral disease such as dental caries and gingivitis.

One lifestyle behavior as an independent variable that was measured was cigarette smoking, which is the practice of burning tobacco and inhaling the smoke. The smoking habit has adverse effects on oral and general health. Question 16 was used to operationalize and measure this concept, which is the number of cigarettes smoked per day.

Another important lifestyle behavior that was measured was the sugary foods and drinks consumption. This also was measured as an independent variable. The type of foods or drinks that people consume has great effect on dental carries. Cakes, candy and sugary drinks

consumption increases the acidity in the mouth, which enhances the bacteria responsible for tooth decay. Questions 17 through 19 were designed to collect information about the type of sugary food and drinks intake as well as the frequency of consumption of such foods and drinks. Another important lifestyle behavior that was measured was the interference of mouth, teeth or gum problems with the student's school, home life and social activities. Question 24 was used to collect information to measure this independent variable.

Self-Perceived General health

General health as an independent variable. Question 26 was designed to collect information about student's general health as described and reported by the students during the last 6 months.

Depression

The last independent variable measured was depression. Information about symptoms of depression were collected using questions 27 and 28. Depression indicators used in these questions included feeling down, depressed, hopelessness and having little interest in doing things.

Access to Oral Healthcare Services

As a control variable in this study, the access to oral health services was studied. Information about access to oral health services was collected using questions 8 through 11. Concepts such as students' ability to gain entry to a proper oral health care system was necessary to achieve a better oral health outcome. Having access to oral health services and the ability to make use of these services help improve the students' oral health status. In addition, insurance

coverage, ease of access and convenience to improve health equity among the underserved students (Harris, 2013).

Access to Fluoridated Water

The second control variable was students' access to fluoridated water supply. Information was collected using question 25. Fluoride is the element that helps recentralize the tooth surface and prevents its decay. This concept was operationalized and measured using this question about the type of water supply the students were using and if they used public water, bottled water or their own well water.

The dependent, independent and control variables are all summarized in Table 2 along with their definitions.

Data Analysis

All data was analyzed using SPSS. Frequency of distribution was calculated for quantitative variables. Descriptive statistics were also performed to summarize the data collected. A bivariate analysis was computed by using cross-tabulation analysis and chi-square to show relationships between dependent and independent categorical variables. Correlation coefficients were calculated to identify relationships between different dependent and independent variables. For inferential statistics, odds ratio and confidence intervals were calculated to increase reliability of the test in addition to the level of significance to reduce study error with $p \leq 0.05$. A binary logistic regression analysis was used after re-coding of variables from categorical to dichotomous to predict dependent variables, namely oral health status. Dependent variables that had more than two response options were dichotomized. For example,

students 'self- described oral health status will be dichotomized (excellent & good) as "good" self-described oral health status, while (fair & poor) as bad self-described oral health status.

Table 2. *Outcome (dependent), independent and control variables with their definitions*

<table>
<tr><th>Dependent Variables</th><th>Independent Variables</th><th>Control Variables</th></tr>
<tr><td rowspan="4">Oral health status: It is the way the students reported and self-described their oral health status, the way the students self-described their oral health status compared to their peers, as well as the absence or presence of impairment or symptoms due to oral disease such as caries, dental fillings, toothaches, facial pain, gum bleeding, bad breath, broken or missing teeth, difficulty in eating and chewing, stained teeth (questions 21 through 23).</td><td>Demographics: age, sex, ethnicity, culture & socio-economic status (questions 1 through 7)</td><td>Access to oral health services: The students' ability to gain access to a proper oral healthcare system. This includes the ability to make use of the services, adequate insurance coverage, easy access and convenience (questions 8 to 11).</td></tr>
<tr><td>Oral hygiene & lifestyle behavior: Oral hygiene is the practice of brushing, flossing, frequency and duration of brushing and flossing as well as use of fluoridated tooth paste and interdental brushes floss (questions 12 through 15). Lifestyle behavior includes smoking and sugary food & drinks consumption (questions 16 through 19). Interference of any of the mouth, gum and teeth problems with the student's home life, school and social life (question 24)</td><td rowspan="3">Access to fluoridated water: The students' accessibility to a water source with an acceptable level of fluoride as a preventive measure against tooth decay. For example, the access to bottled water, public or tap water and well water supply (question 25).</td></tr>
<tr><td>Depression: a mental or mood condition that affects many people. It causes persistent feeling of being down, hopeless and having little interest of pleasure in doing things (Whooley, 1997) (questions 27 and 28).</td></tr>
<tr><td>Self-described General Health: the student's general health as self-described and reported by the students during the last 6 months (question 24)</td></tr>
</table>

Chapter IV- Results

Demographics

There were 226 respondents of the survey among the University of Michigan–Flint students with the majority being female students (77.9%; n=226). Thirty five percent (n=226) of respondents were between ages 18-20 years old, (19.9%; n=226) were between 20 to 22 years of age, (17.7%; n=226) were between 22 and 25 years and (27.4%; n=226) were above the age of 25 years. Among the respondents, (45.1%; n=226) identified themselves as white, (19.5%; n=226) as African-American, (19.5%; n=226) as Middle Eastern, (5.8%; n=226) as Asian, (2.7%; n=226) as Hispanic, (1.8%; n=226) as Native American and (5.8%; n=226) identified themselves of other or of mixed races.

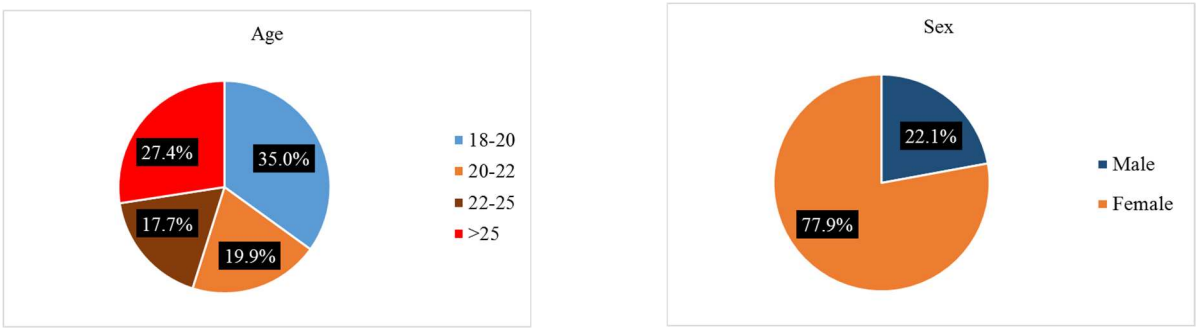

Figure 2. *Age and sex distribution of survey respondents*

Among the respondents, (88.9%; n= 226) responded with English as their primary language, (0.9%; n=226) responded with Spanish as their primary language, while (10.2%; n=226) identified other primary language as their mother tongue. This included languages such as Arabic, Hindi, Tamil, Nepali and Tonga. When asked about their annual income, (35.8%; n=226) of respondents said that they had an annual income that is < $10k, while (19%; n=226) said that their annual income was between $10k and $30k. About (13.7%; n=226) of respondents said that their annual income was >$30k and (22.1%; n=226) of them said that they relied on

their parents for income. The respondents where in different stages of their college years, where (22.6%; n= 226) were first year college students, (14.2%; n= 226) were second year students, (17.7%; n= 226) were third year students, (15.5%; n= 226) were fourth year students, (10.6%; n= 226) were fifth year students and the remaining (18.6%; n=226) identified themselves as graduate students.

Figure 3. *Race and language distribution of survey respondent*

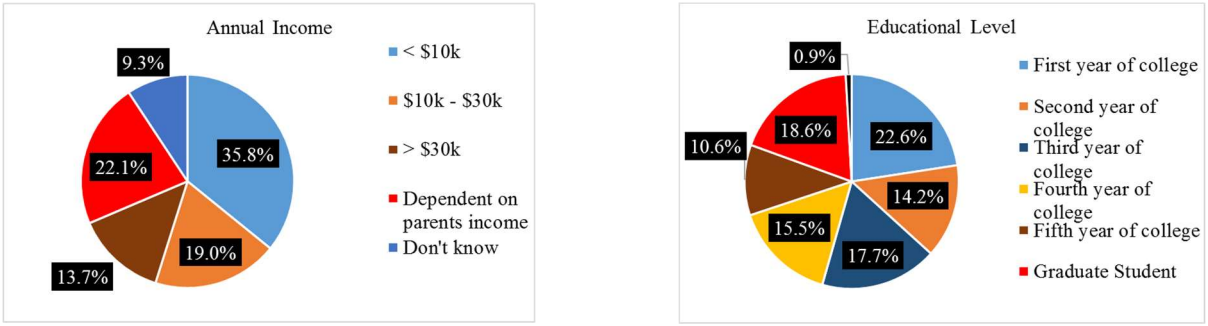

Figure 4. *Annual income and educational level of survey respondents*

Oral Hygiene Behavior

When asked, all respondents to the survey said that they brush their teeth daily and when asked how frequent do they brush, (28.3%; n=226) said that they brush only once while the rest said that they brush twice or more daily. (37.6%; n=226) said that they brushed their teeth for 1 minute or less, while the remaining respondents said they brushed for 2 minutes or more.

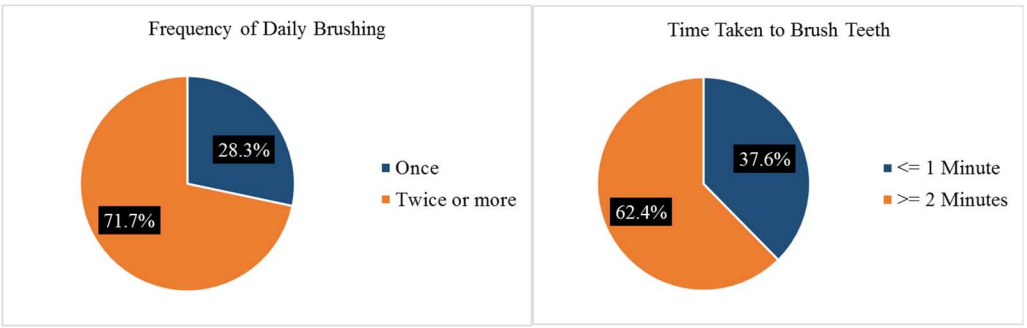

Figure 5. *Frequency of daily brushing and time taken to brush teeth*

When the survey respondents were asked about the use of dental aids other than brushing such as dental floss, fluoridated toothpaste, interdental brushes, toothpicks and mouthwash, (11.5%; n=226) said that they did not use any dental aid, while the rest said that they used at least one dental aid or more.

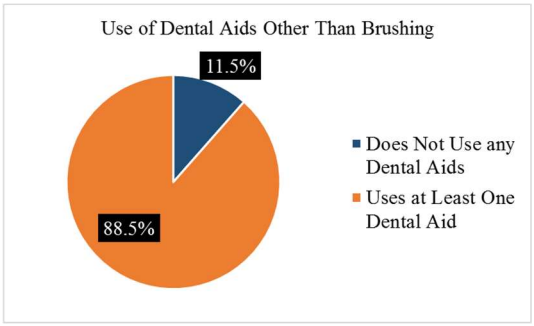

Figure 6. *Use of dental aids other that brushing*

Lifestyle Behavior

The respondents of the survey were asked whether they eat sugary treats and if the answer is yes, the respondents were asked about the frequency of eating these treats. Most respondents (94.7%; n=226) said that they did eat one or more sugary treats on a weekly basis with (45.1%; n=226) saying that they eat those treats frequently daily. When asked about the sugary drinks intake, (87.6%; n=226) said that they had at least one or more sugary drinks during the past week with (51.8%; n=226) saying they have these drinks frequently daily.

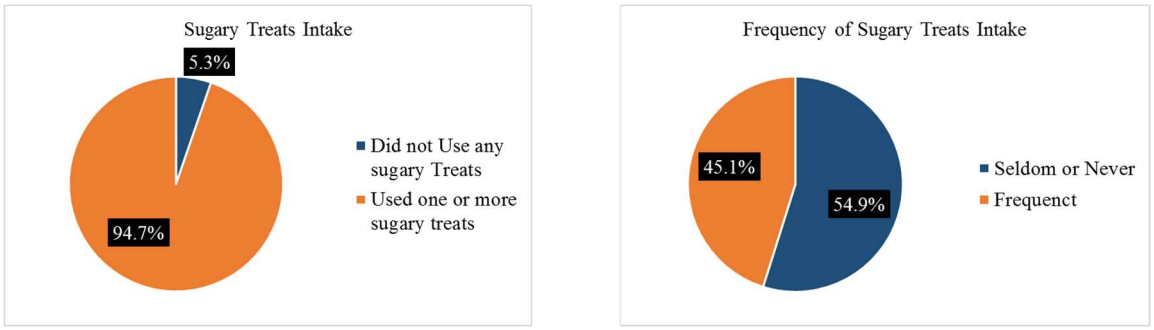

Figure 7. *Sugary treats weekly intake and daily frequency*

Figure 8. *Sugary drinks weekly intake and daily frequency*

The respondents were also asked about whether they smoke cigarettes each day and how many. Most respondents (91.6%; n=226) said that they did not smoke, while the rest said that they smoked at least one cigarette daily. When asked if their oral health issues interfere with their social activities, school or home, the majority (89.8%; n=226) said that these oral health issues did not interfere.

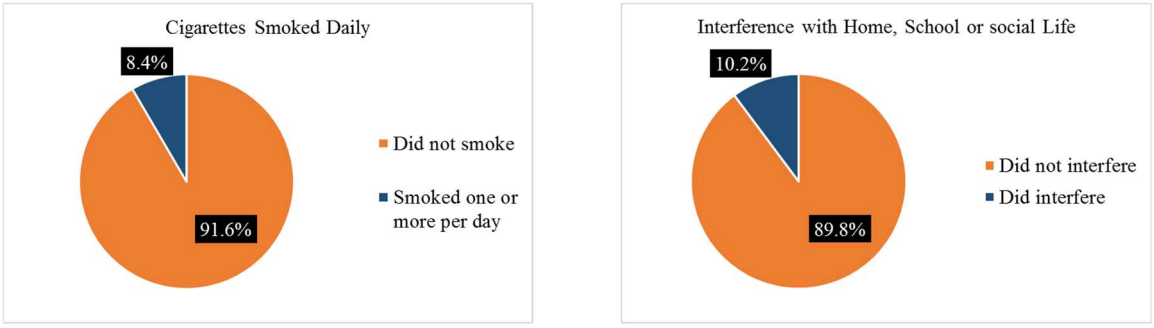

Figure 9. *Cigarettes smoked daily and oral health issues interfering with home, school and social life*

Access to Health Care Services & Fluoridated Water

When asked about the dental insurance coverage, (71.2%; n=226) of respondents said they had dental insurance whether comprehensive, basic, Medicaid or relied on their parent's coverage. The rest did not have any dental insurance coverage. (77%; n=226) of respondents said that they visited the dentist at least once during a 12 months' period and (76.5%; n=226) said they visited a hygienist during the same period. Of the total survey respondents, (53.5%, n=226) of them said they did not use any kind of fluoridated water.

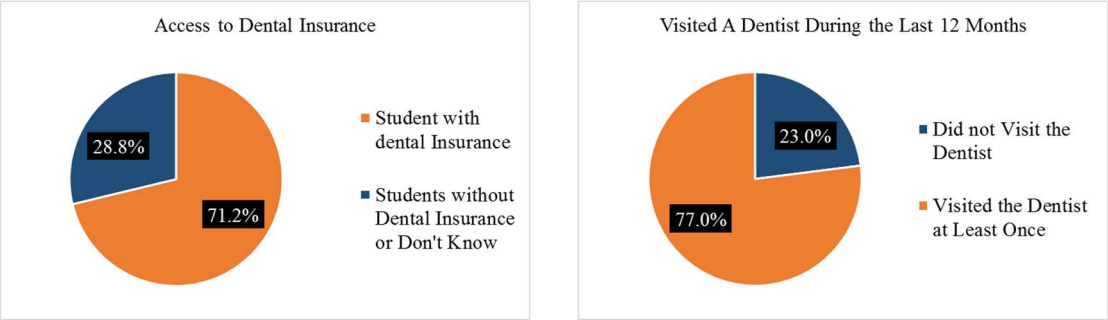

Figure 10. *Access to dental insurance and visiting the dentist in the past 12 months*

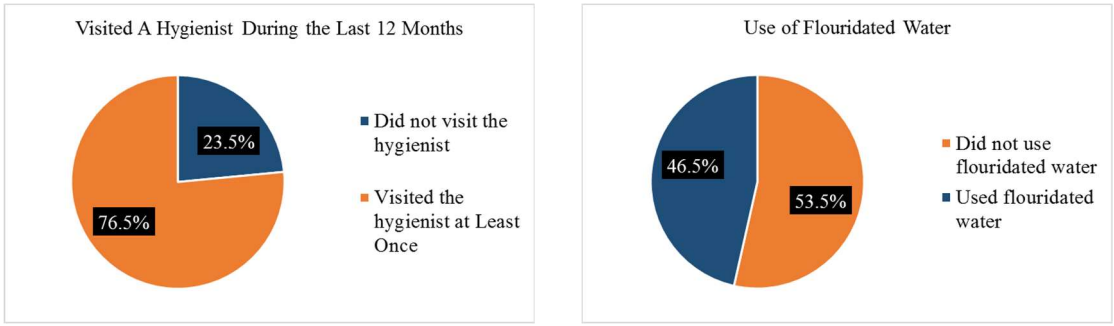

Figure 11. *Visiting the hygienist in the past 12 months and access to fluoridated water*

Depression & General Health

Two questions were used to assess the survey respondent's levels of depression. The first question asked the respondents about how often do they feel depressed and all of them answered

that they seldom or never have felt depressed. When the respondents were asked about their interest in doing things, (78.8%; n=226) of them answered with either never or seldom that they had no interest in doing things. The respondents were also asked about their self-described general health with (88.1%; n=226) perceiving themselves as having good health.

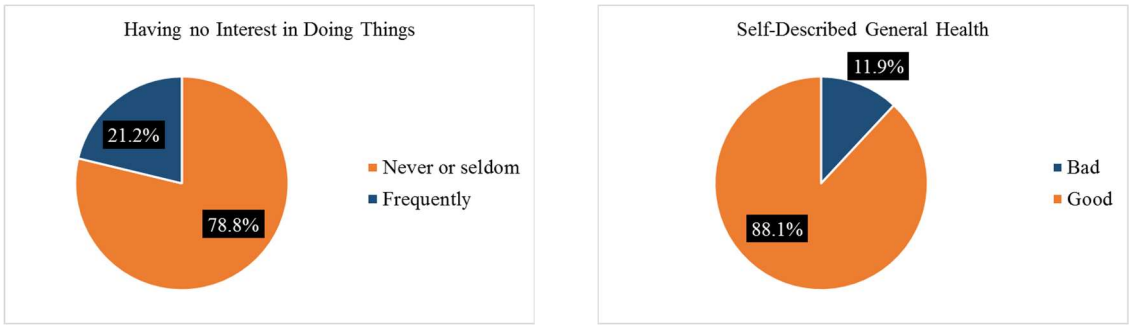

Figure 12. *Having no interest in doing things and self-described general health*

Oral Health Status

Of the total survey respondents, the majority (83.2%; n=226) described themselves of having good oral health and (79.2%; n= 226) of them said that they had as good as or better oral health than their peers. (63.7%; n=225) of respondents said that they did not visit the dentist for any oral problem during the past six months. The oral issues that the respondents were asked about were bad breath, tooth pain, gum bleeding, broken or missing teeth, facial pain, dental caries and difficulty in eating.

Measures of Association: Pearson χ^2, Correlations & Odds Ratios

Using the SPSS statistical analysis software, the investigator conducted a chi-square analysis to establish which of the independent variables (Demographics, oral hygiene & lifestyle behavior and self-described general and mental health as described in Table 2 on page 30) are correlated to the dependent variables (Oral health status also described in Table 2). The results

showed significant associations between a subset of the independent and dependent variables, at a type I error rate (α) of 0.05. Table 3 shows a summary of independent variables that showed significant association with the dependent variable "self-described oral health status.". The odds ratio as well as the 95% confidence intervals were also calculated. All variable associations, correlations, OR and CI are shown in Tables 4 through 7.

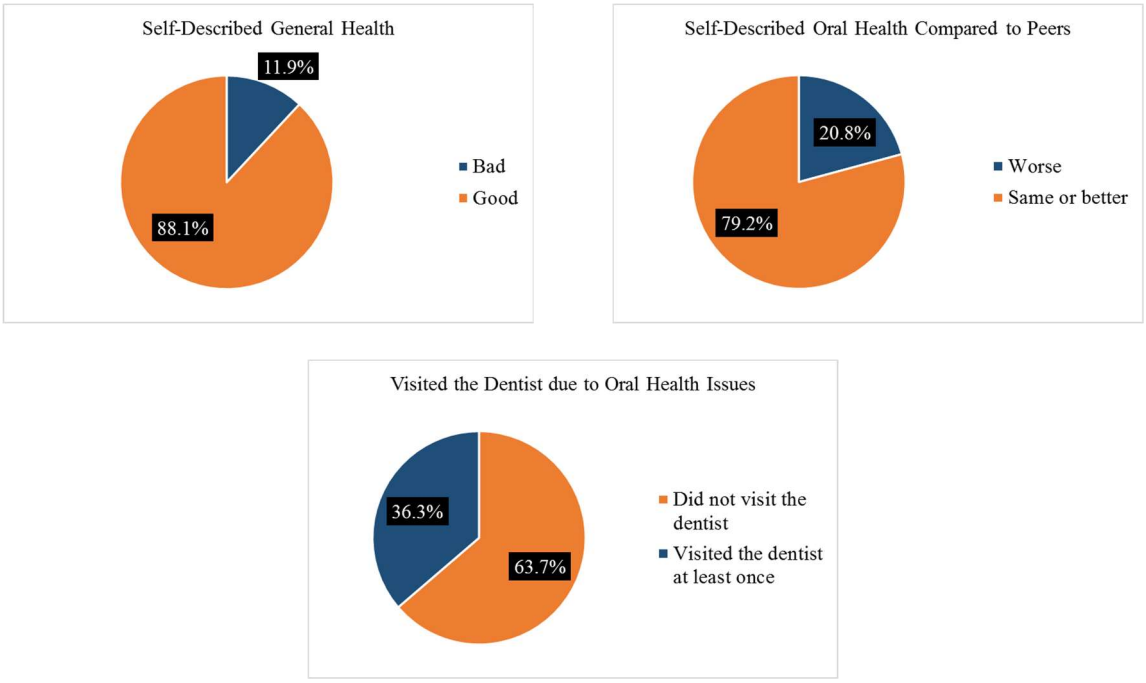

Figure 13. *Self-described oral health, oral health compared to peers and visiting the dentist for one or more oral issues*

Measures of Association: Pearson χ^2, Correlations & Odds Ratios

Using the SPSS statistical analysis software, the investigator conducted a chi-square analysis to establish which of the independent variables (Demographics, oral hygiene & lifestyle behavior and self-described general and mental health as described in Table 2 on page 30) are correlated to the dependent variables (Oral health status also described in Table 2). The results showed significant associations between a subset of the independent and dependent variables, at

a type I error rate (α) of 0.05. Table 3 shows a summary of independent variables that showed significant association with the dependent variable "self-described oral health status.". The odds ratio as well as the 95% confidence intervals were also calculated. All variable associations, correlations, OR and CI are shown in Tables 4 through 7.

Table 3. *Summary of Pearson's χ^2, Correlations & OR of independent variables that showed significant association with self-described oral health (SDOH)*

		Self-Described Oral Health (SDOH)					
		Excellent/Good	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Frequency of Dental Visits	0 Dental Visits	70.6%	0.01	0.18	2.74	1.30	5.76
	At least 1 Dental Annual Visit	86.8%					
Frequency of Hygienist Visits	0 Hygienist Visits	70.6%	0.01	0.19	2.86	1.35	6.06
	At least 1 Hygienest Annual Visit	87.3%					
Brushing Teeth Daily	No	0.0%	0.03	0.15	6.05	4.51	8.13
	Yes	83.5%					
Frequency of Daily Brushing	Never or Seldom	75.0%	0.04	0.14	2.12	1.03	4.37
	Once or More	86.4%					
Use of Flouridated Water	No	78.5%	0.04	0.13	2.12	1.01	4.45
	Yes	88.6%					
Self-Described General Health	Fair / Poor	55.6%	0.01	0.27	5.32	2.24	12.63
	Excellent / Good	86.9%					
Oral Problems Interfered with Life, School or Home	No	85.7%	0.01	-0.20	0.26	0.10	0.65
	Yes	60.9%					

Table 4. *Pearson's χ^2, Correlations & OR of demographics and self-described oral health (SDOH)*

		Self-Described Oral Health (SDOH)					
		Excellent/Good	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Age	< 20	79.7%	0.31	0.07	1.43	0.71	2.94
	>= 20	85.0%					
Sex	Male	84.0%	0.86	-0.01	0.93	0.40	2.17
	Female	83.0%					
Race	White	84.3%	0.68	-0.03	0.86	0.43	1.75
	Non-White	82.3%					
Language	English	82.6%	0.54	0.04	1.48	0.42	5.22
	Non-English	87.5%					
Annual Income	< $30k	83.1%	0.96	0.00	1.02	0.51	2.06
	> $30k or Dependent on Parents	83.3%					
Highest Schooling	Junior or lower	79.7%	0.14	0.10	1.73	0.83	3.58
	Senior or Graduate	87.1%					

Table 5. *Pearson's χ^2, Correlations & OR of depression and self-described oral health (SDOH)*

		Self-Described Oral Health (SDOH)					
		Excellent/Good	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Feeling Depressed	Never or Seldom	83.2%	N/A	N/A	N/A	N/A	N/A
	Frequent	0.0%					
No Interest in doing Things	Never or Seldom	85.4%	0.09	-0.11	0.51	0.24	1.11
	Frequent	75.0%					

Table 6. *Pearson's χ^2, Correlations & OR of oral hygiene & lifestyle behavior and self-described oral health (SDOH)*

		Self-Described Oral Health (SDOH)					
		Excellent/Good	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Brushing Teeth Daily	No	0.0%	0.03	0.15	6.05	4.51	8.13
	Yes	83.5%					
Frequency of Daily Brushing	Never or Seldom	75.0%	0.04	0.14	2.12	1.03	4.37
	Once or More	86.4%					
Daily Brushing Time in Minutes	<= 1 Minute	83.5%	0.92	-0.01	0.96	0.47	1.98
	>= 2 Minutes	83.0%					
Use of Dental Aids Other Than Brushing	Does Not Use Any Dental Aids	88.5%	0.45	-0.05	0.62	0.18	2.16
	Uses One or More Dental Aids	82.5%					
Use of Sugary Treats	None	91.7%	0.42	-0.05	0.44	0.05	3.47
	Uses 1 or More Sugary Treats	82.7%					
Frequency of Sugary Treats	Never or Seldom	85.5%	0.31	-0.07	0.70	0.35	1.40
	Frequent	80.4%					
Use of sugary Drinks	None	82.1%	0.88	0.01	1.09	0.39	3.07
	Uses 1 or More Sugary Drinks	83.3%					
Frequency of Sugary Drinks	Never or Seldom	82.6%	0.81	0.02	1.09	0.54	2.19
	Frequent	83.8%					
Ciggarettes Smoked Per Day	None	83.6%	0.61	-0.03	0.74	0.23	2.36
	>= 1 Cigarette Daily	78.9%					

Table 7. *Pearson's χ^2, Correlations & OR of access to oral health services & fluoridated water and self-described oral health (SDOH)*

		Self-Described Oral Health (SDOH)					
		Excellent/Good	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Frequency of Dental Visits	0 Dental Visits	70.6%	0.01	0.18	2.74	1.30	5.76
	At least 1 Dental Annual Visit	86.8%					
Frequency of Hygienist Visits	0 Hygienist Visits	70.6%	0.01	0.19	2.86	1.35	6.06
	At least 1 Hygienest Annual Visit	87.3%					
Having Dental Insurance	Yes	82.0%	0.45	0.05	1.37	0.61	3.08
	No	86.2%					
Use of Flouridated Water	No	78.5%	0.04	0.13	2.12	1.01	4.45
	Yes	88.6%					
Self-Described General Health	Fair/Bad	55.6%	0.01	0.27	5.32	2.24	12.63
	Excellent/Good	86.9%					
Oral Problems Interfered with Life, School or Home	No	85.7%	0.01	-0.20	0.26	0.10	0.65
	Yes	60.9%					

When Person's χ^2 analysis was applied, the self-described oral health (SDOH) status of students was not found to have an association with demographics (age, sex, race, language, annual income and highest schooling). There was no significant association between SDOH and the two depression independent variables, namely feeling depressed and having no interest in doing things, as well. In both cases, the P-value was greater than 0.05 and the 95% CI of OR crossed 1.

Chi square analyses ere also performed to evaluate the association between oral hygiene & lifestyle behavior and SDOH. A significant association was found between SDOH with oral hygiene behavior of brushing teeth daily (P=0.03, OR=6.05, 95% CI 4.51-8.13) with a positive correlation coefficient of 0.15 and the frequency of brushing teeth (P=0.04, OR=2.12, 95% CI 1.03-4.37) with a positive correlation coefficient of 0.14. No other significant associations were found between other oral hygiene & lifestyle behavior independent variables (Daily brushing time in minutes, use of dental aids other than brushing, use of sugary treats, frequency of sugary

treats, use of sugary drinks, frequency of sugary drinks and cigarettes smoked per day) and SDOH.

A significant association was found between SDOH and access to oral health services specified by frequency of dental visits (P=0.01, OR=2.74, 95% CI 1.30-5.76) and frequency of hygienist visits (P=0.01, OR=2.86, 95% CI 1.35-6.06) with positive correlations of 0.18 and 0.19, respectively. No significant association was found between having dental insurance and SDOH.

There was a significant association between SDOH and use of fluoridated water as a control variable (P=0.04, OR=2.12, 95% CI 1.01-4.45) with a positive correlation coefficient of 0.13. In addition, significant association was found between SDOH and self-described general health status (P=0.01, OR=5.32, 95% CI 2.24-12.63) with a correlation coefficient of 0.27. A significant association was also found between SDOH and the interference of oral health issues with social life, school or home (P= 0.01, OR=0.26, 95% CI 0.10-0.65) with a negative correlation coefficient of -0.20.

Table 8 shows a summary of independent variables significantly associated with the dependent variable "self-described oral health compared to peers." Each of the independent variable associations with "self-described oral health compared to peers" are shown in Tables 9 through 12.

Table 8. *Summary of Pearson's χ^2, Correlations & OR of independent variables that showed significant association with self-described oral health status compared to peers (SDOHCP)*

		Self-Described Oral Health Compared to Peers (SDOHCP)					
		Better/Same	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Brushing Teeth Daily	No	0.0%	0.05	0.13	4.87	3.76	6.30
	Yes	79.5%					
Self-Described General Health	Fair / Poor	59.3%	0.01	0.18	3.11	1.33	7.27
	Excellent / Good	81.9%					

Table 9. *Pearson's χ^2, Correlations & OR of demographics and self-described oral heath compared to peers (SDOHCP)*

		Self-Described Oral Health Compared to Peers (SDOHCP)					
		Better/same	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Age	< 20	83.5%	0.24	-0.08	0.66	0.32	1.33
	>= 20	76.9%					
Sex	Male	76.0%	0.53	0.04	1.27	0.60	2.69
	Female	80.1%					
Race	White	78.4%	0.80	0.02	1.09	0.57	2.07
	Non-White	79.8%					
Language	English	78.1%	0.29	0.07	1.96	0.56	6.88
	Non-English	87.5%					
Annual Income	< $30k	77.4%	0.47	0.05	1.27	0.66	2.45
	> $30k or Dependent on Parents	81.4%					
Highest Schooling	Junior or lower	80.5%	0.55	-0.04	0.82	0.43	1.57
	Senior or Graduate	77.2%					

Table 10. *Pearson's χ^2, Correlations & OR of depression and self-described oral heath compared to peers (SDOHCP)*

		Self-Described Oral Health Compared to Peers (SDOHCP)					
		Same/Better	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Feeling Depressed	Never or Seldom	79.2%	N/A	N/A	N/A	N/A	N/A
	Frequent	0.0%					
No Interest in doing Things	Never or Seldom	81.5%	0.11	-0.11	0.55	0.27	1.15
	Frequent	70.8%					

Table 11. *Pearson's χ^2, Correlations & OR of oral hygiene & lifestyle behavior and self-described oral heath compared to peers (SDOHCP)*

		Self-Described Oral Health Compared to Peers (SDOHCP)					
		Better/Same	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Brushing Teeth Daily	No	0.0%	0.05	0.13	4.87	3.76	6.30
	Yes	79.5%					
Frequency of Daily Brushing	Never or Seldom	75.0%	0.33	0.07	1.41	0.71	2.80
	Once or More	80.9%					
Daily Brushing Time in Minutes	<= 1 Minute	78.8%	0.91	0.01	1.04	0.54	2.01
	>= 2 Minutes	79.4%					
Use of Dental Aids Other Than Brushing	Does Not Use Any Dental Aids	80.8%	0.83	-0.01	0.90	0.32	2.52
	Uses One or More Dental Aids	79.0%					
Use of Sugary Treats	None	91.7%	0.27	-0.07	0.33	0.04	2.64
	Uses 1 or More Sugary Treats	78.5%					
Frequency of Sugary Treats	Never or Seldom	78.2%	0.69	0.03	1.14	0.60	2.18
	Frequent	80.4%					
Use of sugary Drinks	None	78.6%	0.93	0.01	1.04	0.40	2.74
	Uses 1 or More Sugary Drinks	79.3%					
Frequency of Sugary Drinks	Never or Seldom	78.9%	0.91	0.01	1.04	0.55	1.97
	Frequent	79.5%					
Ciggarettes Smoked Per Day	None	79.7%	0.54	-0.04	0.71	0.24	2.09
	>= 1 Cigarette Daily	73.7%					

Table 12. *Pearson's χ^2, Correlations & OR of access to oral health services & fluoridated water and self-described oral heath compared to peers (SDOHCP)*

		Self-Described Oral Health Compared to Peers (SDOHCP)					
		Better/Same	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Frequency of Dental Visits	0 Dental Visits	72.5%	0.19	0.09	1.62	0.79	3.33
	At least 1 Dental Annual Visit	81.0%					
Frequency of Hygienist Visits	0 Hygienist Visits	70.6%	0.07	0.12	1.91	0.93	3.91
	At least 1 Hygienest Annual Visit	82.1%					
Having Dental Insurance	Yes	79.5%	0.86	-0.01	0.94	0.46	1.90
	No	78.5%					
Use of Flouridated Water	No	76.9%	0.35	0.06	1.36	0.71	2.62
	Yes	81.9%					
Self-Described General Health	Fair/Bad	59.3%	0.01	0.18	3.11	1.33	7.27
	Excellent/Good	81.9%					
Oral Problems Interfered with Life, School or Home	No	80.8%	0.08	-0.12	0.45	0.18	1.13
	Yes	65.2%					

Using Pearson's χ^2 analysis, the self-described oral health status compared to peers (SDOHCP) was not found to have an association with demographics (age, sex, race, language, annual income and highest schooling). In addition, there was no significant association between SDOHCP and the two depression independent variables (feeling depressed and having no interest in doing things).

Pearson's χ^2 analysis was also performed to find any association between oral hygiene & lifestyle behavior and SDOHCP. A significant association was found between SDOHCP with oral hygiene behavior of brushing teeth daily (P=0.05, OR=4.87, 95% CI 3.76-6.30) with a positive correlation coefficient of 0.13. No other significant associations were found between other oral hygiene & lifestyle behavior independent variables (Frequency of daily brushing, daily brushing time in minutes, use of dental aids other than brushing, use of sugary treats, frequency of sugary treats, use of sugary drinks, frequency of sugary drinks and cigarettes smoked per day) and SDOHCP.

No significant association was found between access to oral health services (Frequency of dental visits, frequency of hygienist visits and having dental insurance) and SDOHCP. There was a significant association between self-described general health and SDOHCP (P=0.01, OR=3.11, 95% CI 1.33-7.27). A positive correlation coefficient was calculated to be 0.18.

Table 13 shows a summary of independent variables that showed significant association with the dependent variable "dental visits due to oral issues.". All other independent variable associations with "dental visits due to oral issues" are shown in Tables 14 through 17.

Table 13. *Summary of Pearson's χ^2, Correlations & OR of independent variables that showed significant association with dental visits due to oral issues (DVOI)*

		Visited the Dentist Due to Oral Issues (DVOI)					
		Yes	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Race	White	28.4%	0.03	0.15	1.88	1.08	3.28
	Non-White	42.7%					
Frequency of Dental Visits	0 Dental Visits	7.8%	0.01	0.32	9.55	3.30	27.66
	At least 1 Dental Annual Visit	44.8%					
Frequency of Hygienist Visits	0 Hygienist Visits	5.9%	0.01	0.35	13.45	4.03	44.83
	At least 1 Hygienest Annual Visit	45.7%					
Oral Problems Interfered with Life, School or Home	No	32.5%	0.01	0.23	4.74	1.86	12.09
	Yes	69.6%					

Table 14. *Pearson's χ^2, Correlations & OR of demographics and dental visits due to oral issues (DVOI)*

		Visited the Dentist Due to Oral Issues (DVOI)					
		Yes	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Age	< 20	43.0%	0.12	-0.10	0.64	0.37	1.13
	>= 20	32.7%					
Sex	Male	42.0%	0.34	-0.06	0.73	0.39	1.39
	Female	34.7%					
Race	White	28.4%	0.03	0.15	1.88	1.08	3.28
	Non-White	42.7%					
Language	English	35.3%	0.31	0.07	1.55	0.66	3.64
	Non-English	45.8%					
Annual Income	< $30k	33.9%	0.41	0.06	1.26	0.73	2.17
	> $30k or Dependent on Parents	39.2%					
Highest Schooling	Junior or lower	39.8%	0.27	-0.07	0.73	0.42	1.27
	Senior or Graduate	32.7%					

Table 15. *Pearson's χ^2, Correlations & OR of depression and dental visits due to oral issues (DVOI)*

		Visited the Dentist Due to Oral Issues (DVOI)					
		Yes	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Feeling Depressed	Never or Seldom	36.3%	N/A	N/A	N/A	N/A	N/A
	Frequent	0.0%					
No Interest in doing Things	Never or Seldom	34.3%	0.23	0.08	1.49	0.78	2.85
	Frequent	43.8%					

Table 16. *Pearson's χ^2, Correlations & OR of oral hygiene & lifestyle behavior and dental visits due to oral issues (DVOI)*

		Visited the Dentist Due to Oral Issues (DVOI)					
		Yes	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Brushing Teeth Daily	No	0.0%	0.45	0.05	1.57	1.42	1.73
	Yes	36.2%					
Frequency of Daily Brushing	Never or Seldom	37.5%	0.81	-0.02	0.93	0.51	1.69
	Once or More	35.8%					
Daily Brushing Time in Minutes	<= 1 Minute	37.6%	0.74	-0.02	0.91	0.52	1.59
	>= 2 Minutes	35.5%					
Use of Dental Aids Other Than Brushing	Does Not Use Anv Dental Aids	30.8%	0.53	0.04	1.32	0.55	3.19
	Uses One or More Dental Aids	37.0%					
Use of Sugary Treats	None	16.7%	0.15	0.10	2.99	0.64	13.97
	Uses 1 or More Sugary Treats	37.4%					
Frequency of Sugary Treats	Never or Seldom	31.5%	0.10	0.11	1.59	0.92	2.74
	Frequent	42.2%					
Use of sugary Drinks	None	35.7%	0.95	0.00	1.03	0.45	2.35
	Uses 1 or More Sugary Drinks	36.4%					
Frequency of Sugary Drinks	Never or Seldom	37.6%	0.69	-0.03	0.90	0.52	1.54
	Frequent	35.0%					
Ciggarettes Smoked Per Day	None	37.2%	0.35	-0.06	0.60	0.21	1.74
	>= 1 Cigarette Daily	26.3%					

Table 17. *Pearson's χ^2, Correlations & OR of access to oral health services & fluoridated water and dental visits due to oral issues (DVOI)*

		Visited the Dentist Due to Oral Issues (DVOI)					
		Yes	P-Value	Pearson's R	OR	95% Confidence Interval	
						Lower	Upper
Frequency of Dental Visits	0 Dental Visits	7.8%	0.01	0.32	9.55	3.30	27.66
	At least 1 Dental Annual Visit	44.8%					
Frequency of Hygienist Visits	0 Hygienist Visits	5.9%	0.01	0.35	13.45	4.03	44.83
	At least 1 Hygienest Annual Visit	45.7%					
Having Dental Insurance	Yes	38.5%	0.27	-0.07	0.71	0.38	1.31
	No	30.8%					
Use of Flouridated Water	No	38.8%	0.39	-0.06	0.79	0.46	1.36
	Yes	33.3%					
Self-Described General Health	Fair/Bad	33.3%	0.73	0.02	1.16	0.50	2.71
	Excellent/Good	36.7%					
Oral Problems Interfered with Life, School or Home	No	32.5%	0.01	0.23	4.74	1.86	12.09
	Yes	69.6%					

Pearson's χ^2 analysis was applied to test the association between the dependent variable dental visits due to an oral issue (DVOI) and demographics. A significant association was found

between race and DVOI (P=0.03, OR=1.88, 95% CI 1.08-3.28) with a positive correlation coefficient of 0.15. No other significant associations were found between other demographic independent variables (age, sex, language, annual income and highest schooling) and DVOI. No significant association between DVOI and the two depression independent variables (feeling depressed and having no interest in doing things) was found as well.

Pearson's χ^2 analysis was also performed to address associations between oral hygiene & lifestyle behavior (Brushing teeth daily, frequency of daily brushing, daily brushing time in minutes, use of dental aids other than brushing, use of sugary treats, frequency of sugary treats, use of sugary drinks, frequency of sugary drinks and cigarettes smoked per day) and DVOI, no significant association was found.

Significant association was found between access to oral health services specified by frequency of dental visits and DVOI (P=0.01, OR=9.55, 95% CI 3.30-27.66) with a positive correlation coefficient of 0.32. A significant association was also found between frequency of hygienist visits and DVOI (P=0.01, OR=13.45, 95% CI 4.03-44.83), with a positive correlation coefficient of 0.35. In addition, there was a significant association between oral problem interfered with life, school or home and DVOI (P=0.01, OR=4.74, 95% CI 1.86-12.09), with a positive correlation coefficient of 0.23. No significant association was found between having dental insurance, use of fluoridated water and self-described general health and DVOI was found.

Logistic Regression Modeling

Binary logistic regression models were used to address the relationship between the independent and dependent variables. Tables 18, 19 and 20 show the model summaries for all

three dependent variables and the odds ratios, confidence intervals, and associated p-values of independent variables that were used in each regression model.

Table 18. *Binary logistic regression equation variables and summary for self-described oral health (SDOH)*

	Sig.	OR	95% Confidence Interval	
			Lower	Upper
Frequency of Dentist Visits	0.56	1.61	0.32	8.06
Frequency of Teeth Brushing Daily	0.05	2.29	1.00	5.26
Self-Described General Health	0.01	7.16	2.60	19.77
Oral Issues Interfere with Home,	0.01	0.18	0.06	0.51
Constant	0.02	0.21		
Step	**-2 Log likelihood**			
1	164.038			

For the logistic regression model of the self-described oral health (SDOH) status, only four independent variables contributed to the equation in addition to the constant. These variables were frequency of dental visits (P=0.56, OR=1.61, 95% CI 0.32-8.06), frequency of teeth brushing daily (P=0.05, OR=2.29, 95% CI 1.00-5.26), self-described general health (P=0.01, OR=7.16, 95% CI 2.60-19.77) and oral issues interfere with home, school and social life (P=0.01, OR=0.18, 95% CI 0.06-0.51).

Table 19. *Binary logistic regression equation variables and summary for self-described oral health status compared to peers (SDOHCP)*

	Sig.	OR	95% Confidence Interval	
			Lower	Upper
Self-Described General Health	0.01	3.11	1.33	7.27
Constant	0.34	1.45		
Step	**-2 Log likelihood**			
1	224.658[a]			

For the logistic regression model of the self-described oral health compared to peers (SDOHCP), only one independent variable contributed to the equation in addition to the constant, which is the self-described general health (P=0.01, OR=3.11, 95% CI 1.33-7.27).

Table 20. *Binary logistic regression equation variables and summary for dental visits due to oral issues (DVOI)*

	Sig.	OR	95% Confidence Interval	
			Lower	Upper
Race	0.16	1.56	0.84	2.90
Frequency of Dentist Visits	0.41	2.11	0.36	12.37
Frequency of Dental Hygienist Visits	0.03	7.48	1.22	45.76
Oral Issues Interfere with Home, School & Social Life	0.01	4.13	1.42	12.02
Constant	0.01	0.04		
Step	**-2 Log likelihood**			
1	247.572[a]			

For the logistic regression model of the dental visits due to oral issues (DVOI), five independent variables contributed to the equation in addition to the constant. These variables were race (P=0.16, OR=1.56, 95% CI 0.84-2.90), frequency of dental visits (P=0.41, OR=2.11, 95% CI 0.36-12.37), frequency of dental hygienist visits (P=0.03, OR=7.48, 95% CI 1.22-45.76) and oral issues interfere with home, school and social life (P=0.01, OR=4.13, 95% CI 1.42-12.02).

Chapter IV-Discussion

This study is one of the first to examine the oral health status among students attending one Midwestern university, namely the University of Michigan-Flint. Students aged 18 years or older were asked to complete a Qualtrics online survey. The students were asked to assess their own oral health status as a dependent variable, where three different questions targeted this outcome: Self-described oral health (SDOH), self-described oral health compared to peers (SDOHCP) and dental visits due to oral issues (DVOI). A sample of 226 students completed the survey and the results were analyzed using the SPSS statistical package.

The focus of this study analysis centers on the association of a comprehensive set of independent variables to assess oral health status. The characteristics of primary determinants of oral health that include socio-demographic factors, oral hygiene & lifestyle behavior, access to oral health services, use of fluoridated water, depression, self-described general health and effects of oral health on social life, school and home.

Discussion of Associations

Self-Described Oral Health Status (SDOH)

When Person's χ^2 analysis was applied to SDOH and demographics, no significant associations were found. The absence of associations between SDOH and age, gender, race, socioeconomic status and educational level is inconsistent with previously published studies where age, gender race and socioeconomic status are directly associated with SDOH (DHHS, 2000; Hilton & Berdar, 2013; Åstrøm & Joyce Rose, 2001; Dogan & Gökalp, 2014; Peltzer & Pengpid, 2014). In this study, most socio-demographical groups (age, gender, race, language, level of education and annual income) self-described and reported an excellent/ good SDOH

(>80% of respondents) and no significant relationships were found compared to the null hypothesis. The results could be attributed to the fact that 77.9% of respondents were females who tend to have good SDOH as described in previous literature (Luebke & Driskell, 2010). This result refuted Hypothesis III, that younger age will be associated with poorer oral health.

No significant association was found between depression with SDOH in contrast to other studies, where depression was shown to influence poor oral and general health outcomes as well as oral health behavior such as oral hygiene and accessing oral health services (Park, 2014; Halonen et al., 2014; Bernson et al., 2013; Okoro et al., 2012). The reason for this result was that 100% of all respondents reported that they were not feeling depressed and 78.8% of respondents reported that never or seldom had any feelings of being down or having no interest in doing things. These high percentages caused the association results to be negligible when the Person's χ^2 test was applied. This result also refuted part of hypothesis number II, where it was hypothesized that depression is negatively associated with self-described oral health status.

To test the first hypothesis in this work, which is that proper oral hygiene and lifestyle behavior are positively associated with SDOH, the Pearson's chi square analysis was completed. A significant positive association was found between SDOH and oral hygiene behavior exhibited in two independent variables, namely brushing teeth daily and frequency of daily brushing. These findings are consistent with previous studies such as the one published by Olusile indicating the importance of tooth brushing and frequency of brushing and their impact on quality of oral health (Olusile, Adeniyi, & Orebanjo, 2014). A preventive strategy such as tooth brushing and flossing at the individual level helps reduce the negative impact of oral disease and improves the quality of life. The frequency of brushing is also recommended by the American

Dental Association (ADA) to be at least twice daily (after wakeup and before sleep) as well as brushing and flossing after each meal (ADA, 2013).

Other determinants of oral hygiene and lifestyle behaviors were not found to be associated with SDOH. Daily teeth brushing time did not affect the self-perception of oral health status as the answers to this question were random in nature and students did not know exactly how much time was spent on brushing. The use of dental aids other than brushing was very high among respondents (88.5% reported using at least one or more dental aids). This high percentage caused a bias in the association results and no association was found, which is inconsistent with other published reports (ADA, 2013).

The association between oral health behavior (intake and frequency of sugary foods and drinks) and SDOH was found to be non-significant in contrast to other published studies where the researchers examined the different life style trends such as sugar and pop consumption habits and their effects on oral health (Luebke & Driskell, 2010). Most of the respondents in this study reported having at least one or more sugary treats or drinks per week (94.7% used at least one sugary treat & 87.6% used at least one sugary drink), however, when asked about the frequency of intake, the percentages were almost split in half (54.9% said seldom or never had sugary treats). This inconsistency in answers led to no associations to be found with SDOH.

A non-significant association was found between smoking and SDOH, which is in contrast to previously published literature where clinical studies have shown that current or former smokers manifested a higher prevalence of oral health problems than those who have never smoked (Millar & Locker, 2007; ADA, 2013). The reason for this result in this study was because most respondents did not smoke (91.6% reported they do not smoke).

Access to dental health services, such as frequency of dental and hygienist visits was used as a control variable. A significant association was found between dental visits and hygienist visits and SDOH. This result is consistent with the findings of the National Institute of Dental & Craniofacial Research stating that access to dental health services is a determining factor in having good oral health (NIDCR, 2014).

The second control variable in this study was the use of fluoridated water, where significant association was found with SDOH. This is consistent with previously published studies, which dealt with access to fluoridated water supply in the United States (DHHS, 2000; CDC 1999). This preventive measure had a great effect on the promotion of oral health status and on the reduction of dental caries among American communities who have access to fluoridated water since fluoridation was found to be a positive factor in reducing oral health issues such as cavities and dental caries (CDC, 1999; CDC 2009).

Significant association between self-described general health status and SDOH was found, which is consistent with previously published literature. Many studies suggested that individuals who self-described and reported excellent/good oral health were more likely to report excellent/good general health (Atchison & Gift, 1997; Benyamini, Leventhal & Leventhal, 2004). This is consistent with part of Hypothesis number II, where it was hypothesized that poor self-described general health is negatively associated with self-described oral health.

A significant number of respondents (60.9%) said that oral health issues interfered with their social life, school or home even though they reported good SDOH. This is inconsistent with previously published literature where poor oral health had negative consequences on an individual's performance, school, home and work (Holt & Barzel; 2013). The reason is most likely due to bias in answering the question about interference with one's performance, school,

home or work. Most respondents probably assumed this was a general question about poor oral health interfered with such activities and answering yes to the interference portion while at the same time reporting good SDOH. The question should have been reformulated to ask whether current oral health issues interfered with these activities. Self-Described Oral Health Status Compared to Peers (SDOHCP)

When Pearson's χ^2 analysis was applied to SDOHCP and demographics, depression, oral hygiene & lifestyle behavior and access to oral health service, only one significant association was found, namely brushing teeth daily. This surprising result can be explained by the fact that students tend to report that their SDOHCP is always same or better than their peers (79.2% reported same or better SDOHCP) either because of a desire to be same or better than their peers or because of lack of knowledge about their peers self-described oral health.

A significant association was found between self-described general health ad SDOHCP, which is consistent with previously published literature where many studies suggested that individuals who self-described and reported excellent/good oral health were more likely to report excellent/good general health (Atchison & Gift, 1997; Benyamini, Leventhal & Leventhal, 2004).

Dental Visits Due to an Oral Issue (DVOI)

The third and last dependent variable in this study is the dental visits due to an oral issue (DVOI), which is also an indicator of oral health status. The association of DVOI with all independent variables was tested using the Pearson's χ^2 test, where only 4 significant associations were found. The first significant association was found between race and DVOI. Race as a demographic group was recoded into a dichotomous variable with 2 levels, namely, white and non-white. This is consistent with previously published literature (Hilton, Stephen, Barker & Weintraub JA, 2007) where the authors showed that non-white

students have almost twice as likely to visit a dentist due to an oral issue as opposed to white students. No other significant associations were found between demographics and DVOI. This is probably explained by the fact that most of the respondents were female students (77.9%) and more than half of the respondents were between the age of 18 to 22 years.

There was no significant association found between depression and DVOI, where this is inconsistent with previously published literature where studies found that students who are depressed are less likely to access oral health services such as visiting the dentist (Park, 2014; Halonen et al., 2014; Bernson et al., 2013; Okoro et al., 2012). The reason for this result was that 100% of all respondents reported that they were not feeling depressed and 78.8% of respondents reported that never or seldom had they any feelings of being down or having no interest in doing things. These high percentages caused the association results to be negligible when the Person's χ^2 test was applied.

Access to health care services as described by dentist and hygienist visits were found to have a significant relationship with DVOI. This is consistent with previously published reports (Peterson & Yamamoto, 2005; Locker, Maggirias & Wexler, 2009), where a positive association was found, which indicates that students who visit the dentist or hygienist regularly seem to report an issue with their oral health.

A significant association was found between the interference of oral health issues with social life, school and home and DVOI. This result shows that when a student has an oral health issue, this issue is twice as likely to interfere with the student's social life, school work or home. This is consistent with previously published literature, where students who visit the dentist for an oral issue are usually affected by this issue in their home, school or social life, whether this is

due to pain, lack of concentration and self-esteem or they are unable to socialize (Holt & Barzel, 2013).

Discussion of Regression Modeling

Binary logistic regression modeling was used to assess predictors of the three dependent variables used to measure oral health status, namely SDOH, SDOHCP and DVOI. Table 18 shows the binary logistic equation variables for SDOH. The four independent variables used to build this regression equation were: Frequency of dental visits, frequency of daily brushing, self-described general health and oral issues interference with work, home or school. Odds ratios (OR), p values, and 95% CI were calculated for each independent variable as well as the -2 log likelihood (a measure of model fit). The odds of having an excellent/good SDOH was not statistically significantly different for students who frequently visited the dentist as opposed to those who did not. This result is not statistically significant. The odds of having excellent/good SDOH were 2.3 times greater for students who brushed their teeth frequently than students who did not. Finally, students who reported that oral issues interfered with their work, school or home were almost 5 times less likely to have excellent/good SDOH than students who did not.

The Hosmer and Lemeshow test, which gives the predictive probability of the regression model against the actual observed outcomes, was calculated and the results are shown in Figure 14. The test signifies how well the regression model can predict the outcome where the participants are separated in 7 different categories. As can be seen in the Figure 14, the regression model predictive nature tracked well the observed outcomes with some variations for both the excellent/good SDOH and fair/poor SDOH outcomes. The predictive nature seems to be more accurate when the outcome of the SDOH is excellent/good.

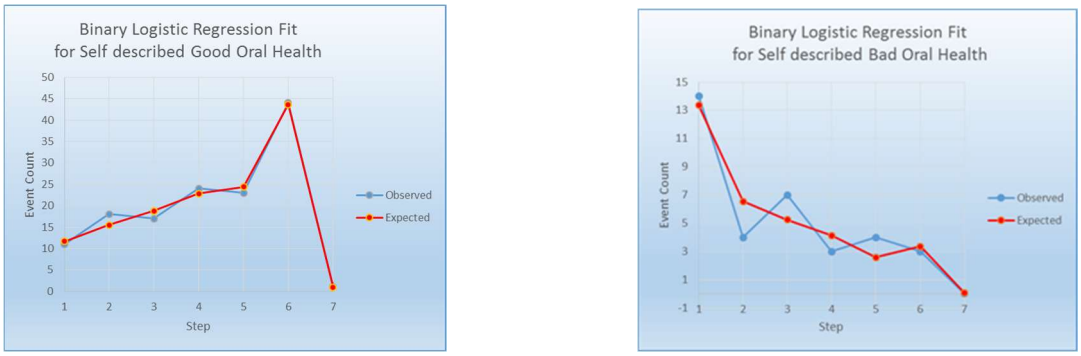

Figure 14. *Hosmer and Lemeshow test of the regression model predicted vs. actual observed outcomes for both excellent/good SDOH & fair/poor SDOH*

For the dependent variable self-described oral health compared to peers (SDOHCP), the only significant independent variable that contributed to the regression equation was the self-described general health shown in Table 19. Students who reported excellent/good self-described general health were 3 times more likely to report excellent/good SDOHCP.

Finally, a binary logistic regression model was developed to predict the DVOI dependent variable. Students who were non-white were not statistically more likely to have visited the dentist for an oral issue. Students who visited the dentist frequently were not statistically more likely to have visited the dentist for a dental issue. The students who visited the hygienist frequently were 7.5 times more likely to have visited the dentist for a dental issue, but the extremely wide confidence interval of this estimate is problematic. The last variable in the regression model was that an oral issue has affected work, school or home, where students who reported a positive effect of an oral issue on their work, school or home were 4.1 times more likely to have visited the dentist for an oral issue.

The Hosmer and Lemeshow test was calculated and the results are shown in Figure 15. The binary logistic regression model predictive nature tracked well the observed outcomes for

both the DVOH-No and DVOH-Yes outcomes. The predictive nature seems to track both outcomes with very good accuracy.

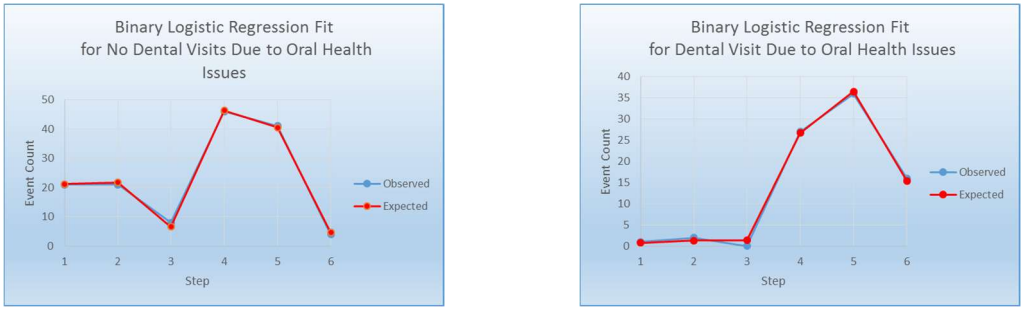

Figure 15. *Hosmer and Lemeshow test of the regression model predicted vs. actual observed outcomes for both DVOH-No & DVOH-Yes.*

Chapter V- Conclusion

A survey of the students at the university of Michigan-Flint was conducted to evaluate self-described oral health status. A survey questionnaire was sent to all students via email using the Qualtrics system. 226 students responded to the survey with the majority being female. The target of the study was to assess the association between the independent variables such as demographics, oral hygiene and lifestyle behavior, depression and general health and oral health status. Fluoridated water and access to health care services were the control variables. Oral health status was defined by three variables, namely, self-described oral health (SDOH), self-described oral health compared to peers (SDOHCP) and self-described dental visits due to an oral issue (DVOI).

The investigator hypothesized that proper oral hygiene and lifestyle behavior will be positively associated with oral health status. The investigator also hypothesized that depression and fair/poor self-described general health are negatively associated with self-described oral health status. In addition, it was hypothesized that younger age will be associated with poorer oral health status.

Significant positive association between oral hygiene behavior described by daily teeth brushing and excellent/good SDOH and better/same SDOHCP, while significant positive association between frequency of teeth brushing was found with excellent/good SDOH. Self-described general health status was found to have strong positive association with both excellent/good SDOH and better/same SDOHCP as well. The two control variables described by access to health care services and use of fluoridated water were also found to have strong positive association with excellent/good SDOH and DVOI. These findings support the first hypothesis in this work, which agrees with previously published literature.

No association was found between depression as an independent variable and any of the oral health status indicators such as SDOH, SDOHCP and DVOI. This finding refutes the second hypothesis in this work, which hypothesized that a positive association exists. In addition, no association was found between younger age and SDOH, SDOHCP and DVOI, which also refutes the third hypothesis in this work.

Lifestyle behavior described by oral health issues interfering with work, life and school was also found to have significant negative association with SDOH and DVOI, which was unexpected but was rationalized as an outlier since students responded to this question without relating it to their current SDOH and DVOI status.

A binary regression model was developed for each of the three oral health status indicators to try to predict future outcomes. The accuracy of the regression models for both SDOH and DVOI was very good, while the accuracy of the model for SDOHCP was found to be inadequate.

Strengths and Limitations

Strengths of Study

The strengths of this study are as follows:

1) The use of descriptive cross-sectional design has made it possible in this study to collect sufficient information about multiple risk factors such as depression, brushing and flossing, smoking and sugary food and drink intake in association with oral health status among students at the University of Michigan-Flint.
2) The use of this design was cost-effective and less time consuming than longitudinal or experimental designs. The study could test and document the hypothesis, estimate

oral behavior proportion among university students to promote public health planning for better oral health.

3) Sampling of diverse students in the cross-sectional design has increased the external validity of the study and its representativeness of the population of interest.
4) The use of an online survey with self-rated questionnaire to collect data made it easier to collect abundance of information faster and more cost-effective than the use of clinical data. An online survey was convenient and fits with the students' fast rhythm lifestyle. Self–reported oral health questionnaire have been used in many national health surveys and is a valid instrument that provides researchers with oral health status indicators (Peker, 2012).
5) The perception of university students about their own oral health helped to provide more information about how certain diseases affect individual life (Peker, 2012). This in turn will promote oral health programs that meet the students' needs.
6) Multiple independent variables in association with oral health status were assessed to enhance the reliability of the survey while adjusting for several control variables.

Limitations of Study

The study had several limitations as described below:

1) data was collected using a cross-sectional design at one point in time. It was a snapshot of student's data where temporal relationships between independent and dependent variables cannot be achieved.
2) It was impossible to prove a causal relationship between the oral health behavior and the oral health status since confounding effects might bias this causal relationship

even though control variables were included. The use of experimental or longitudinal designs despite the loss of follow up in this design will be able to prove causality.

3) Most survey respondents were female students, which made it difficult to generalize the results to all university students.
4) The use of a web survey led to a limited response, which led to bias and a reduction in external validity. This could have been avoided by sending reminders through email to the participants in addition to incentives that might have increased their response rate and reduce attrition.
5) Recall bias is another limitation that might have occurred or that the respondents might have answered what fits their social desirability. The researcher might have shifted the questions and answers to his or her own interest. Randomization will help to generalize the study to a larger population and it can be replicated for different settings or times to increase its external validity. The use of proper design such as experimental design with randomly assigned students will help reduce the design error and increase internal validity, instead of the use of convenience sampling method due to time constraint. This will also help to reduce bias and control for confounder to prove causality.
6) The study did not include any clinical examinations by the dentist, therefore the results reflect the relationship that is only found between self-reporting and oral health status. This means that survey results might have been biased towards what the respondents thought and desired. Future studies can be designed to evaluate the relationship between clinical examination and self-reported oral health status.

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Appendix B- Sample Student E-Mail Invitation

Dear students,

I am conducting a research study on oral/dental health as a requirement for completing my Master of Science in Health Education. I am asking students at the University of Michigan-Flint to complete a survey about this topic. For example, I am interested in learning how your eating behaviors, brushing, and mood affect your dental health. Your opinions are very important to me. The survey has 28 questions. Your participation in the survey is completely voluntary and you can terminate the survey by closing your browser at any time if you wish.

If you have questions about this research study, you can contact me at the below email, or call the Department at (810) 762-3172. If you have questions about your rights as a research participant, please contact the UM Flint Institutional Review Board, 303 E Kersley, 4204 William S White Bldg., Flint, MI 48502-1950, Telephone: (810) 762-3384, email: irb-flint@umflint.edu.

By clicking on "Yes, I agree to participate", you are consenting to participate in this research survey. If you do not wish to participate, please select "No, I do not wish to participate" to exit the survey.

Rand Duzdar

Department of Public Health & Health Sciences

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Appendix C- Study Questionnaire

Demographics

1) What is your age?

   - <18
   - 18-20
   - 20-22
   - 22-25
   - >25

2) What is your sex?

- Male
- Female

3) How do you describe yourself?

- White non-Latino
- African American
- Hispanic or Latino
- Asian
- Native American
- Middle Eastern
- Other (Please specify) _____

4) What is your highest year of school completed?

- First year of college
- Second year of college
- Third year of college
- Fourth year of college
- Fifth year of college (not a Graduate student)
- Graduate student

5) What is your primary language?

- English
- Spanish
- Arabic
- Other (Please specify) ____

6) What is your annual income that you can use as a student for your daily life (you can exclude tuition from this income)?

- Under $ 10,000 a year
- Between $ 10,000 - $ 30,000 a year
- More than $30,000 a year
- Dependent on parent's income
  Don't know

Access to Oral Health Services

7) What kind of dental insurance do you have?

- Private comprehensive (insurance that covers many services such as crowns)

- Private basic insurance (insurance that only covers cleanings and fillings)

- Medicaid

- Don't know

- No dental insurance

8) I didn't see a dentist or dental hygienist during the last 12 months because …..

- Not applicable (I saw a dentist or dental hygienist in the last 12 months)
- I didn't have a problem in my mouth
- I didn't think it was important
- I didn't have transportation
- I couldn't afford the treatment
- I didn't have insurance
- I have insurance but couldn't afford the copay
- I was waiting for an appointment because not many dentists are in my area

9) During the last year, how many times did you visit your dentist for dental checkups?

- Once per year
- Twice per year
- More than twice per year
- I have not visited the dentist this year

10) During the last year, how many times did you see your dental hygienist for a dental cleaning?

- Once per year
- Twice per year
- More than twice per year
- None

Oral & Lifestyle Behavior

11) How many times do you brush your teeth daily?

- Once per day
- Twice per day
- More than twice per day
- None

12) Do you use any of the following to clean your teeth at least once a day? Please check all that apply.

- Dental floss
- Tooth picks
- Inter dental teeth brushes
- Fluoridated tooth paste
- Mouth wash
- None

13) If you checked any of the above, how often do you use it to clean your teeth?

- often (more than 3 times a day)
- Sometimes (3 times or less a day)
- seldom (once a week or when needed)
- Never

14) How long do you brush your teeth each time?

- Less than one minute
- One minute
- Two minutes
- More than two minutes
- Don't know

15) How many cigarettes do you smoke each day?

- 1-3 cigarettes a day

- 3-6 cigarettes a day
- One pack a day
- More than one Pack a day
- I do not smoke

16) During the last week, did you eat sugary treats? Please check all that apply.

- Cookies
- Chocolate
- Candy
- Ice-cream
- Other
- None

17) How often did you eat any of the checked treats above?

- Very often (more than twice a day)
- Fairly often (less than twice a day)
- Occasionally (once a week)
- Never

18) During the last week, did you drink any of the following? Please check all that apply

- Coffee
- Frappe
- Smoothie
- Pop
- Energy drinks
- Other
- None

19) If you checked any of the above drinks, how often do you drink?

- Often (more than 3 times a day)
- Sometimes (3 or 2 times a day)
- Seldom (once a week)
- Never

Oral & General Health Status

20) During the last 6 months, how do you describe the condition of your mouth, teeth and gum?

- Excellent
- Good

- Fair
- Poor

21) How would you rate the condition of your mouth, teeth and gum compared to people your age?

- Better
- The same
- Not as good
  Don't know

22) During the last 6 months, did you visit a dentist for any of the following problems in your mouth? Please check all that apply

- Bleeding gums
- Missing or broken teeth
- Bad breath
- Facial Pain
- Difficulty in easting or swallowing
- Cavities and dental caries need to be treated
- Tooth pain/ aches

23) During the last 6 months, did you have any of the following problems that lasted more than one day? Please check all that apply

- Bad breath
- Tooth pain/aches
- Gum bleeding
- Broken or missing teeth
- Difficulty in eating or chewing
- Facial pain
- Cavities and dental caries
- I have not visited the dentist in the last 6 months.

24) Did any of the problems in your mouth, teeth or gum during the last 6 months interfered with any of the following? Please check all that apply

- School
- Social activities
- Home life
- None

25) During the last six months, how do you describe your health in general:

- Excellent
- Good

- Fair
- Poor

Access to fluoridated water

26) During the last year where have you received your drinking water from?

- Tap or public water
- Well
- Bottled water

Depression

27) During the last month, have you often been bothered by feeling down, depressed or hopeless. Please mark the appropriate answer.

- Never
- Almost never
- Sometimes
- Fairly often
- Very often

28) During the past month, have you often been bothered by little interest of pleasure in doing things. Please mark how often you felt or thought the following way:

- Never
- Almost never
- Sometimes
- Fairly often
- Very often

Appendix D – Survey Results

Demographics

Table 21. *Demographical statistics of survey respondents*

Demographics					
	Count	**%**		**Count**	**%**
Age			**Language**		
18-20	79	35.0	English	201	88.9
20-22	45	19.9	Spanish	2	.9
22-25	40	17.7	Other	22	9.7
>25	62	27.4	Missing	1	0.4
Race			**Educational Level**		
White	102	45.1	First year of college	51	22.6
African American	44	19.5	Second year of college	32	14.2
Hispanic or Latino	6	2.7	Third year of college	40	17.7
Asian	13	5.8	Fourth year of college	35	15.5
Native American	4	1.8	Fifth year of college	24	10.6
Middle Eastern	44	19.5	Graduate Student	42	18.6
Other	13	5.8	Missing	2	.9
Annual Income			**Sex**		
< $10k	81	35.8	Male	50	22.1
$10k - $30k	43	19.0	Female	176	77.9
> $30k	31	13.7			
Dependent on parents income	50	22.1			
Don't know	21	9.3			

Oral Hygiene Behavior

Table 22. *Oral hygiene behavior of survey respondents*

Oral Hygiene Behavior		
	Count	**%**
Daily Teeth Brushing		
Does Not Brush Daily	0	0.0
Brushes Daily	226	100.0
Frequency of Daily Brushing		
Once	64	28.3
Twice or more	162	71.7
Time Taken to Brush Teeth		
<= 1 Minute	85	37.6
>= 2 Minutes	141	62.4
Use of Dental Aids Other Than Brushing		
Does Not Use any Dental Aids	26	11.5
Uses at Least One Dental Aid	200	88.5

Lifestyle Oral Behavior

Table 23. *Lifestyle oral behavior of survey respondents*

Oral Lifestyle Behavior		
	Count	**%**
Sugary Treats Intake		
Did not Use any sugary Treats	12	5.31
Used one or more sugary treats	214	94.69
Frequency of Sugary Treats Intake		
Seldom or Never	124	54.9
Frequenct	102	45.1
Sugary Drinks Intake		
Did not Use any sugary drinks	28	12.4
Used one or more sugary drinks	198	87.6
Frequency of Sugary Drinks Intake		
Seldom or Never	109	48.2
Frequenct	117	51.8
Cigarettes Smoked Daily		
Did not smoke	207	91.6
Smoked one or more per day	19	8.4
Interference with Home, School or social Life		
Did not interfere	203	89.8
Did interfere	23	10.2

Depression & General Health

Table 24. *Self-described general health and depression levels of survey respondents*

Depression & General Health		
	Count	**%**
Feeling Depressed		
Never or seldom	226	100.0
Frequently	0	0.0
Having no Interest in Doing Things		
Never or seldom	178	78.8
Frequently	48	21.2
Self-Described General Health		
Bad	27	11.9
Good	199	88.1

Access to Oral Health services & Fluoridated water

Table 25. *Access to oral health services and fluoridated water of survey respondents*

Control Variables		
	Count	**%**
Access to Dental Insurance		
Student with dental Insurance	161	71.2
Students without Dental Insurance or Don't Know	65	28.8
Visited A Dentist During the Last 12 Months		
Did not Visit the Dentist	52	23.0
Visited the Dentist at Least Once	174	77.0
Visited A Hygienist During the Last 12 Months		
Did not visit the hygienist	53	23.5
Visited the hygienist at Least Once	173	76.5
Use of Flouridated Water		
Did not use flouridated water	121	53.5
Used flouridated water	105	46.5

Oral Health Status

Table 26. *Oral health status of survey respondents*

Oral Health Status		
	Count	**%**
Self-Described Oral Health		
Bad	38	16.81
Good	188	83.19
Self-Described Oral Health Compared to Peers		
Worse	47	20.8
Same or better	179	79.2
Visited the Dentist due to Oral Health Issues		
Did not visit the dentist	144	63.7
Visited the dentist at least once	82	36.3